



WISC pattern analysis : a comparison of techniques for the diagnosis of minimal brain dysfunction in school children

by Dwight James Leonard

A dissertation submitted in partial fulfillment of the requirements for the degree of DOCTOR OF EDUCATION

Montana State University

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Abstract:

Eight different WISC scoring methods used for diagnosing minimal brain dysfunction (MBD) were mathematically formalized. Discriminant analysis was used for testing the 24 MBD equations in the comparison of 76 children diagnosed as MBD against 37 children diagnosed emotionally disturbed. Using all 24 MBD scores, a definite distinction was made between clinically diagnosed MBD groups and emotionally disturbed groups at a significant level of $p < .005$ for an F. There were 18 wrong diagnoses (15.9%) made in 113 cases: 05, 24, 88, = 2.9. Of the individual methods, only those of Money (1962) or Bannatyne (1971) were able to significantly distinguish the MBD from the emotionally disturbed groups ($p < .005$; with 32 and 36 wrong diagnoses, respectively). The methods of Clements and Peters' (1962) and McGlannan (1968) were predictive of emotional disturbance instead of for MBD.

It was concluded that the WISC can be used to distinguish between children with MBD and those with emotional disturbance. However, the diagnostic use of the WISC must take into consideration that MBD is not a single syndrome and, therefore, different scoring methods must be computed. It was felt that the results of the present study can be useful in an educational testing situation given the availability of desk mini-computers.

WISC PATTERN ANALYSIS: A COMPARISON OF TECHNIQUES FOR THE
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SCHOOL AGE CHILDREN

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ABSTRACT

Eight different WISC scoring methods used for diagnosing minimal brain dysfunction (MBD) were mathematically formalized. Discriminant analysis was used for testing the 24 MBD equations in the comparison of 76 children diagnosed as MBD against 37 children diagnosed emotionally disturbed. Using all 24 MBD scores, a definite distinction was made between clinically diagnosed MBD groups and emotionally disturbed groups at a significant level of $p < .005$ for an $F_{.05, 24, 88} = 2.9$. There were 18 wrong diagnoses (15.9%) made in 113 cases.

Of the individual methods, only those of Money (1962) or Bannatyne (1971) were able to significantly distinguish the MBD from the emotionally disturbed groups ($p < .005$; with 32 and 36 wrong diagnoses, respectively). The methods of Clements and Peters' (1962) and McGlannan (1968) were predictive of emotional disturbance instead of for MBD.

It was concluded that the WISC can be used to distinguish between children with MBD and those with emotional disturbance. However, the diagnostic use of the WISC must take into consideration that MBD is not a single syndrome and, therefore, different scoring methods must be computed. It was felt that the results of the present study can be useful in an educational testing situation given the availability of desk mini-computers.

Chapter 1

Introduction

The diagnosis of Minimal Brain Dysfunction (MBD) in children is an important issue for education because such diagnoses may show that the child who does not perform well in the classroom may not be stubborn, retarded, unmotivated or emotionally disturbed, but may in fact be neurologically handicapped. For example, the child who seems quite normal at recess may be handicapped in the classroom by dyslexia, or "word blindness," and therefore unable to read at his age level. When a teacher tries to cope with a child who apparently cannot read, he or she needs to know whether the child is mentally retarded, emotionally disturbed, or has a neurological handicap which appears as a learning disability or behavior disorder. The teacher is vitally interested in having an accurate diagnosis of the problem in order that appropriate remedial procedures may be taken. The parents too are vitally interested in their children's learning problems, while the children themselves must suffer their failures without knowing the cause. It is for these reasons that the diagnosis or identification of MBD (minimal brain dysfunction) is vital.

The diagnosis of MBD is generally made in a team approach where a psychologist, social worker, neurologist or psychiatrist, educator, and others pool their information and attempt to establish mental retardation, emotional disturbance, or MBD. The child who is referred

to this team is usually having academic problems and/or emotional problems associated with school failure and social failure. An accurate diagnosis results in proper treatment; e.g. the identification of MBD associated with dyslexia would suggest that such treatment be educational remediation rather than psychotherapy or placement in special education classes. The diagnosis can often be made by the psychologist on the team because it is through his tests that emotional disturbance, mental retardation or MBD can be differentially established although the final diagnosis is always made through the efforts of the entire team. Thus, the use of psychological tests is quite important in diagnosis, and specifically, the intelligence test is relied upon for diagnosis of mental retardation and MBD.

In the past there has been much debate among psychologists as to the validity of test interpretation and especially that done from a pattern of test scores such as the subscores from the WISC (Wechsler Intelligence Scale for Children). Proponents of diagnostic psychological testing (Wechsler, 1958) state that complex performance tests such as those contained in the WISC are more sensitive as indicators of impaired cerebral functioning than simple neurological tests. Critics of diagnostic psychological testing note the conflicting results produced by different examiners, the lack of supporting neurological criteria, and the failure of many studies to find a significant correlation between neurologically established brain damage and

psychological test diagnosis of brain damage (Yates, 1954). It is for these reasons that this study has been undertaken. More experimental results are needed to evaluate the contribution of diagnostic psychological testing in this area; and especially the use of diagnostic patterns on the Weschler Intelligence Scale for Children (WISC).

The Problem: How to Differentiate Between MBD
and Emotional Disorder

This study offers a statistical evaluation of eight different methods of scoring WISC patterns in order to determine their ability to distinguish between a group of children diagnosed MBD and a group of children diagnosed as having emotional problems. The population studied was a group of 246 school children who were diagnosed at the Butte Mental Hygiene Clinic, Butte, Montana, from 1970 through 1972. The ages of the children was between 5 and 16 in keeping with age limitations of the WISC. The final clinical diagnosis was used in order to classify the children into either MBD or emotional problem groups.

Diagnosis by Pattern and Scatter Analysis

The Wechsler Intelligence Scale for Children (WISC) offers various scoring patterns possibly reflecting the presence of MBD.

The test consists of 12 subtests, each sampling aptitude in different areas of intellectual functioning (Wechsler, 1949).

The test was designed statistically so that the average child can be expected to earn a score of 10 points on each of the 12 subtests. Expected, or average, performance then on each of the tests yields a "flat" profile; i.e. most children will not deviate significantly from a scaled score of 10, with a standard deviation of 3 on each of the tests.

The psychologist, when confronted with a subtest pattern exceeding the above "normal" limits of variability on the test, is obliged to explain or account for the unexpected variability. He will ask himself, is this child emotionally disturbed, anxiety ridden, neurologically impaired (brain-damaged), or culturally deprived.

It is suggested here that certain patterns of subtest scatter are related to a sometimes elusive syndrome, a type of "organicity," which has been described in the literature as MBD.

Specific WISC Scoring Methods for Diagnosing MBD

The scoring patterns employed in this study are those proposed by Money (1962), Bannatyne (1971), Wechsler (1958), McGlannan (1968), Clements and Peters (1962), Reitan (1962), Wills and Banas (1971), and an experimental pattern proposed by the author of this study. Some of the scoring methods such as those of Money (1962) and Bannatyne (1971) were originally proposed for learning disabilities but were used in this study to diagnose MBD. On the assumption that a learning

disability sometimes implies MBD, McGlannan's (1968) scoring for dyslexia, and Wills and Banas (1971) three patterns for learning disabilities were used for diagnosis of MBD. Clements (1962), Reitan, (1962) and Wechsler (1958) have all proposed specific methods of scoring the WISC subtests in order to establish a MBD diagnosis. This author will also present a scoring pattern.

Studies of brain damage in adults were conducted by Halstead (1947). His studies yielded the most comprehensive test battery available for the assessment of brain-damaged patients. The tests were validated by Reitan who also extended them downward for use with adolescents and younger children (Reed, Reitan and Klove, 1965). However the emphasis in these studies was on a test battery and use of the subtests of the WISC was only a supplementary source of data. These studies did point out different syndromes and symptom patterns of brain damage. The studies sometimes were able to localize actual damaged portion of the brain (later verified on neurological tests) (Russell, Neuringer, and Goldstein, 1970).

Reitan's Patterns

Using the Wechsler-Bellevue I, Reitan and his colleagues have suggested that there are two major relationships between IQ test scores and brain damage: when the left side of the head sustains damage, the Verbal IQ is lower than the Performance IQ; when the damage is to the right side of the head, the Performance IQ will be lower than the

Verbal IQ. They have cited evidence that these relationships exist and thus there are actually two different patterns of brain damage (Reitan, 1955). There is some question whether these results are found on the WISC (Matarazzo, 1972, p. 394).

Wechsler's Brain Damage Profile

Wechsler suggested that various patterns of scores on the Wechsler Adult Intelligence Scale (WAIS) reflect brain damage in adults (Wechsler, 1958). Although these patterns were derived from the WAIS, they have been generalized to the WISC.

Wechsler felt that the profile in Table 1 was not diagnostic of any one brain damage syndrome such as brain tumor or chronic alcoholism, but illustrated the disorganization of intellectual processes observed in most brain damage cases, irrespective of type. He suggests that "the most general symptoms of organic brain cases are disturbances in the visual-motor spheres, a loss of shift, memory defects, and a falling off of capacities involving organization and synthetic ability" (Wechsler, 1958, p. 174).

Perhaps the greatest influence Wechsler has had on profile and pattern analysis was the use of a number of sub-scales which are converted to standard scaled scores. It was then easy to compare the child's functioning in various test areas with the norm, and against each other. Figure 1 has an example of the WISC profile of a child who was clinically diagnosed as MBD compared with Wechsler's suggested

profile for brain damage. In this case the correlation between the Verbal areas is good, but the performance areas are negatively correlated. Although the profile is useful in diagnosing brain syndromes, the individual differences are varied and cannot be expected to fit any one profile exactly.

Table 1
An Adaptation of Wechsler's Brain Damage Profile

WISC Subtest	Scaled Score
Information	12
Comprehension	12
Arithmetic	8
Similarities	8
Vocabulary	13
Digit Span	7
Picture Completion	9
Picture Arrangement	10
Block Design	7
Object Assembly	8
Coding	7

(adapted from Wechsler, 1958, p. 171)

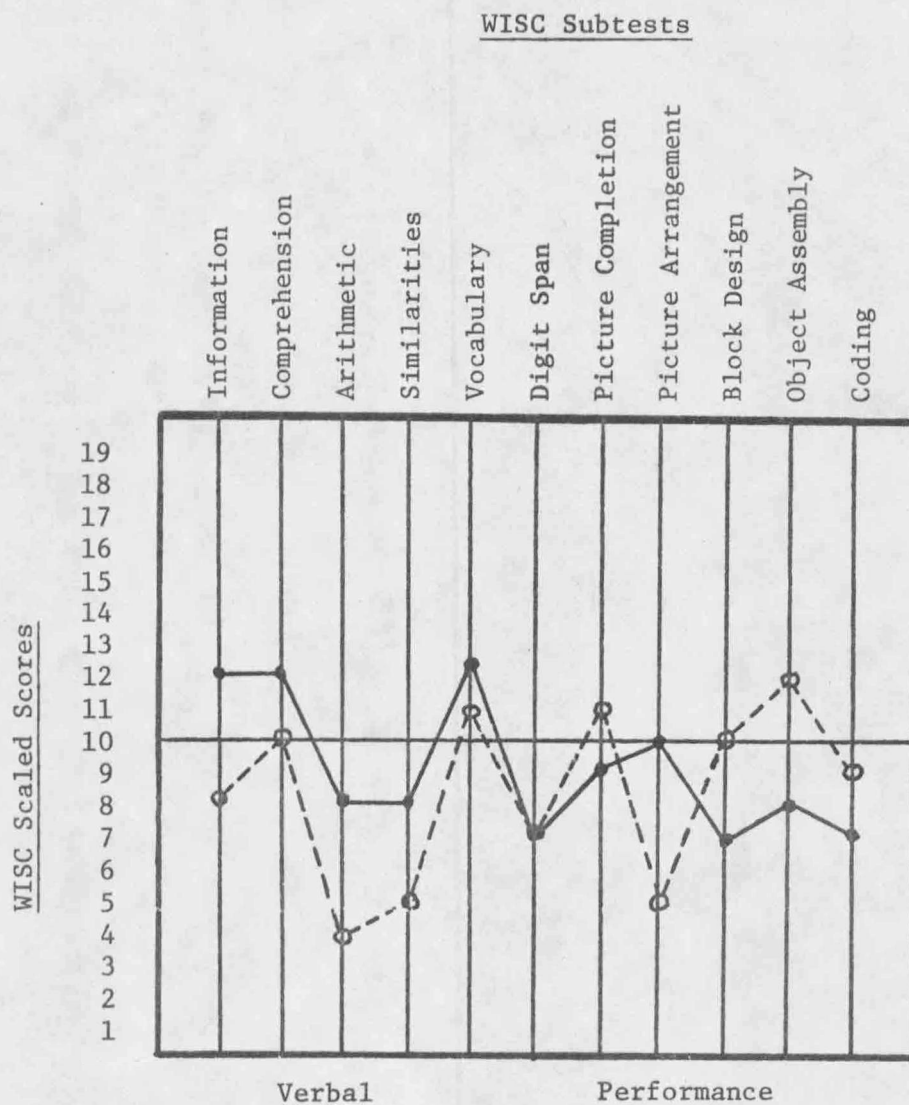


Figure 1. An example of Wechsler's brain damage (●—●) with the profile (○---○) of one child's case #4673 who was clinically diagnosed MBD.

Clements and Peters Three Patterns

Clements and Peters (1962) have developed the most comprehensive patterns indicative of three different MBD syndromes. However, there is little corroborating experimental evidence to establish the validity of these measures.

Clements and Peters (1962) specifically suggest the following patterns:

WISC Pattern A

1. Scatter in either or both verbal and performance scales.
2. Low scores (relative to the others) most frequently in Arithmetic, Block Design, Object Assembly, Digit Span, Coding and Mazes.
3. Final verbal and performance IQ scores often nearly equal. (Note internal inconsistency.) -Not uncommon to find Comprehension 5 to 10 points higher than Arithmetic. -Not uncommon to find Picture Completion 5 to 10 points higher than Block Design.

WISC Pattern B

1. Verbal IQ 15 to 40 points higher than performance IQ. (In this instance the achievement on the verbal tasks is sufficiently high to obscure or to compensate for a drop in Arithmetic. If the Arithmetic score is excluded, the difference is more pronounced, this test being another type of symbol process.)
2. Trouble with most of the performance scale items, particularly with pure visual-motor tasks which include Block Design, Object Assembly, Coding, and Mazes; less difficulty with Picture Arrangement and Picture Completion. (Often the performance IQ falls within the mentally deficient range, while the verbal IQ falls within or above the normal range.)

WISC Pattern C

1. Least frequent pattern.
2. Performance IQ 10 to 30 points higher than verbal IQ (This child, generally considered to have dyslexia, has difficulty in expressing himself verbally. He must actively search for the words necessary to express his usually concrete solution to a "thought" problem. On the other hand, he is quite proficient at the subtests which constitute the performance scale.) (Clements and Peters, 1962)

McGlannan's Dyslexia Profiles

McGlannan (1968) suggested two profiles that identify dyslexia. The patterns for specific dyslexia and complex dyslexia in Table 2 involve only four WISC subtests.

Table 2

McGlannan's Two Dyslexia Profiles

WISC Subtests	Specific Dyslexia	Complex Dyslexia
Similarities	15	6
Digit Span	8	8
Block Design	11	11
Coding	6	8

Money's Factor Analytically Derived Patterns

Money (1962) suggests that pattern scoring can be calculated from subtests using the results of Cohen's factor analytic studies (Cohen, 1959). He proposed the categories in Table 3.

Table 3

Money's Pattern for Learning Disabilities

Patterns	WISC/Subtests
Perceptual Organization	1. Block Design 2. Object Assembly
Verbal Comprehension	1. Information 2. Comprehension
Freedom from Distractibility	1. Arithmetic 2. Digit Span

Money suggested that the average score of the subtests for each of the patterns could be compared to the individual's average IQ. A discrepancy between the two averages would suggest a learning disability depending on the degree of the discrepancy.

Bannatyne's Patterns for Learning Disabilities

Bannatyne (1971) also suggested a pattern method similar to that of Money (1962) but was able to furnish some empirical proof of the validity of his categories. Bannatyne's patterns are found in Table 4.

Table 4

Bannatyne's Patterns for Learning Disabilities

Pattern	WISC Subtests
Special	1. Picture Completion 2. Block Design 3. Object Assembly
Conceptual	1. Comprehension 2. Similarities 3. Vocabulary
Sequencing	1. Coding 2. Digit Span 3. Picture Arrangement

Like Money (1962) Bannatyne suggested a learning disability could be found if any of the pattern averages were significantly lower from the individuals general averages on the subtests of the WISC.

An Experimental Profile

The experimental scoring pattern suggested by this author (cf. Table 5) is useful to diagnose children who have auditory discrimination and auditory memory problems. Clinically it has been noticed that children of this type tend to have lower Verbal IQ's than Performance IQ's and specifically that the subtests Comprehension, Vocabulary, Digit Span, and Information will generally all be several points below the mean of the total subtests.

Table 5

An Experimental Profile for MBD

WISC Subtest	Scaled Scores
Information	7
Comprehension	6
Arithmetic	10
Similarities	10
Vocabulary	6
Digit Span	7
Picture Completion	10
Picture Arrangement	10
Block Design	10
Object Assembly	10
Coding	10

The neurological condition found in approximately 30 percent of these cases is a positive abnormal EEG with indications of seizure patterns and sometimes an epileptic diagnosis.

Wills and Banas' Three Profiles for MBD

Wills and Banas (1971) offer three different profiles of MBD or learning disabilities. They suggest there is a "Vulnerable Child" who is dyslexic, a "Fragile Child" who has a language disability, and the "Enchanted Prince" who is neurologically impaired. Essentially they suggest that the neurologically impaired child has an average IQ but suffers from both dyslexia and language disability. They suggest the three typical profiles in Table 6

Table 6

Wills and Banas Three Learning Disability Profiles

Test	Dyslexia	Language Disability	Neurologically Impaired
Information	9	11	7
Comprehension	12	10	10
Arithmetic	9	10	6
Similarities	14	8	11
Vocabulary	11	12	10
Digit Span	9	11	6
Picture Completion	9	11	6
Picture Arrangement	11	8	7
Block Design	14	8	8
Object Assembly	11	11	6
Coding	8	10	8

Need for the Study

Increasing emphasis on learning disorders, minimal brain damage, and similar concepts in both education and mental health work has suggested that many problems formerly classed as emotional are in fact neurological disorders. It is estimated by some authorities that learning difficulties affect between 5 to 20 percent of the non-retarded child population, depending on how learning disabilities are defined (Tarnopol, 1971). In view of the magnitude of this problem, it is essential to develop methods for accurate diagnosis and to refer cases to the proper treatment specialist whether it be a pediatrician, psychotherapist, or learning disability expert.

Although scoring methods for diagnosing brain damage have been described and validated in the work of Halstead and Reitan, (Reitan, 1962) these methods are, for the most part, limited to the WAIS (Wechsler Adult Intelligence Scale) and other tests used to diagnose brain damage in adults. Secondly, although Reitan and others (Russell, Neuringer and Goldstein, 1970) constructed diagnostic test batteries for children, the test batteries are more oriented toward clear-cut brain damage and not the borderline minimal brain syndrome that is of interest in this study.

Since many studies have used only a single scoring method for MBD, it is felt that use of several different scoring methods may provide more information and better differentiate between MBD and the

emotionally disturbed groups. For example, McGlannan (1968) offers a scoring method that is specifically designed for reading disabilities whereas Wechsler's scoring method (Wechsler, 1958) is more inclusive and is oriented toward brain damage in general. Some of the authors realize that MBD may present itself differently in different cases, so Clements and Peters (1967) and Wills and Banas (1971) offer several different scoring patterns.

The validation of the various scoring patterns has been a problem since different criteria groups of MBD versus normal children have generally been used. Some scoring patterns such as Clements and Peters (1962) and Wills and Banas (1971) offer only clinical impressions with little experimental validation.

In view of the above situation, there seems to be a definite need to compare different scoring methods in a clinical situation where practical diagnosis of MBD versus emotional disturbance is the main object.

General Questions to be Answered

The objective of this study was to test the ability of various MBD scoring patterns to successfully distinguish between groups labeled emotionally disturbed and those labeled MBD.

The main question is whether all of the scoring patterns used in a discriminant function can distinguish between children who are

emotionally disturbed or have MBD. There is also the question as to which scoring pattern or group of scoring patterns most effectively distinguishes between groups.

General Procedure

The underlying question of whether MBD is a general syndrome or a group of different syndromes suggested the present approach. A group of different MBD scoring patterns were used to evaluate the WISC scores of two groups of children. One group had been identified by clinical diagnosis as MBD and the other group included only those diagnosed as emotionally disturbed.

The MBD scores produced by the different WISC scoring systems were analyzed by a two-group discriminant analysis. The purpose of this analysis was to determine if the two clinically diagnosed groups could be differentiated by appropriate weightings applied to the MBD scores. Each of the MBD scores alone or groups of MBD scores associated with a particular theorists viewpoint were analyzed to find which of the MBD scores significantly contributes to the statistical separation of the two known diagnostic groups.

The Two-Group Discriminant Function

If there are differences between the MBD and emotionally disturbed groups on the basis of their WISC scores, then these differences can be calculated with a discriminant function. The MBD

scores are taken for each individual and added together so that scores $X_1 + X_2 + X_3 + \dots + X_N = \sum_{n=1}^N X_n$ are arranged. Constants are added to the linear equation so it looks like $K_1 X_1 + K_2 X_2 + K_3 X_3 + \dots + K_n X_n + \sum_{n=1}^n K_n X_n$. It is this equation that Fisher (1936) suggested could be analyzed by a discriminant function as a solution to the problem of using information from a number of correlated scores.

The discriminant function classifies an unclassified object into one of two groups to which it must belong. The classification is done by taking the ratio of the among groups sum-of-squares of this linear function to the within-groups-sum of squares. This ratio is then maximized by adjusting the constants K (or weights) so that this ratio would have a larger value than that for any other linear function of the variables (Cooley and Lohnes, 1962, p. 117).

One advantage of discriminant analysis is that it tends to use most of the information in the scores and it expresses this information in a concise form of a single discriminant score (Cooley and Lohnes, 1962). When the scores are expressed in a linear equation, the Central Limit Theorem suggests that the result of this combination of a group of scores is more likely to be normal than each of the scores taken alone (Tatsuoka & Tiedeman, 1954). In addition, tests of statistical significance are available for the separation of the groups for a particular discriminant function (Cooley & Lohnes, 1962). The relative contributions of the original variables to a discriminant function can

be judged by the F-test so that the degree of discrimination between the emotionally disturbed and MBD groups using the scoring patterns, will be revealed. With the above information the answer can be provided to the generalized multivariate null hypothesis, that the emotionally disturbed group and the MBD groups have the same scores. If the null hypothesis is rejected, then the group difference can be evaluated by inspecting the group mean values, and the discriminant values.

The assumptions for a discriminant analysis are 1) a normal distribution of the scores of the individuals, 2) a random sample, and 3) equal variance-covariance matrices. Violation of the assumptions reduce the chance of achieving the maximum-likelihood solution to the set of linear equations. In that case, the sensitivity of the test is reduced and significant findings would be more conservative than for the optimum condition (Tatsuoka & Tiedeman, 1954).

Limitations

This study was necessarily limited to a specific population of children between the ages of 5 and 16 who were referred to a mental hygiene clinic. The final clinical diagnosis at a mental hygiene clinic is not easily replicated since it is a composite of judgments of a clinical staff. However, one can easily generalize from this type of finding to other mental hygiene clinics with a similar staff comprised of psychiatrist, psychologist, social worker, psychiatric nurse along

with school psychologist, consulting neurologist and other professional input. Although it is impossible to replicate the study with the same subjects and the same judges, generalization is possible because of the similarity of the clinical situations.

The sample size is limited to 246 children referred to the clinic over a two-year span from 1970 to 1972. Since many clinics use short forms of the WISC or do little work with school-age children, an appropriate test group is difficult to obtain. The availability of sufficient qualified personnel at the Butte clinic, together with proper neurological referral and other professional staff made this particular sample the best that could be found in Montana and the easiest to obtain data on.

Definition of Terms

Behavior disorders of childhood and adolescence 308.

This major category is reserved for disorders occurring in childhood and adolescence that are more stable, internalized, and resistant to treatment than Transient situational disturbances (q.v.) but less so than Psychoses, Neuroses, and Personality disorders (q.v.). This intermediate stability is attributed to the greater fluidity of all behavior at this age. Characteristic manifestations include such symptoms as overactivity, inattentiveness, shyness, feeling of rejection, over-aggressiveness, timidity, and delinquency (DSM II, 1968, p. 49).

Hyperkinetic Reaction of Childhood (or adolescence) 308.0

This disorder is characterized by overactivity, restlessness, distractibility, and short attention span, especially in young

children; the behavior usually diminishes in adolescence. (DSM II, 1968, p. 50).

Neuroses 300

Anxiety is the chief characteristic of the neuroses. It may be felt and expressed directly, or it may be controlled unconsciously and automatically by conversion, displacement and various other psychological mechanisms. Generally, these mechanisms produce symptoms experienced as subjective distress from which the patient desires relief.

The neuroses, as contrasted by the psychoses, manifest neither gross distortion or misinterpretation of external reality, nor gross personality disorganization. A possible exception to this is hysterical neurosis, which some believe may occasionally be accompanied by hallucinations and other symptoms encountered in psychoses.

Traditionally, neurotic patients, however severely handicapped by their symptoms, are not classified as psychotic because they are aware that their mental functioning is disturbed (DSM II, 1968, p. 39).

Non-Psychotic Organic Brain Syndromes 309

This category is for patients who have an organic brain syndrome but are not psychotic.

In children mild brain damage often manifests itself by hyperactivity, short attention span, easy distractability, and impulsiveness. Sometimes the child is withdrawn, perseverative, and unresponsive. In exceptional cases there may be great difficulty in initiating action. These characteristics often contribute to a negative interaction between parent and child. If the organic handicap is the major etiological factor and the child is not psychotic, the case should be classified here (DSM II, 1968, p. 32).

Pattern Analysis

From Wechsler (1958, p. 165) "pattern analysis" is:

to find a way or formula for identifying diagnostically different groups, and eventually the individuals composing them, on the basis of their differential performance on a

number of tests administered as a battery. Implicit in all such attempts is the assumption that test scores can be combined into and identified as unique combinations.

Personality disorders 301

This group of disorders is characterized by deeply ingrained maladaptive patterns of behavior that are perceptibly different in quality from psychotic and neurotic symptoms. Generally, these are life-long patterns, often recognizable by the time of adolescence or earlier. Sometimes the pattern is determined primarily by malfunctioning of the brain, but such cases should be classified under one of the non-psychotic organic brain syndromes rather than here (DSM II, 1968, p. 41).

Minimal Brain Dysfunction

Minimal brain dysfunction (MBD) has been used as a term to imply a child has a neurological handicap that impairs cognitive, affective, or psychomotor functioning; however the impairment is not so severe as to be classified as a cerebral palsy, epilepsy, blindness, etc. The definition of MBD used in this study will be that of Clements (1966) who suggested that MBD refers to:

children of near average, average, or above average general intelligence with certain learning or behavioral disabilities ranging from mild to severe, which are associated with deviations of function of the central nervous system. These deviations may manifest themselves by various combinations of impairment in perception, conceptualization, language, memory, and control of attention, impulse and motor control (Clements, 1966, p. 9).

Along with Clement (1966), this study recognizes that there are two extreme views regarding the very existence of a condition called "minimal brain dysfunction." Some take the view that MBD can only have meaning if physiological, biochemical, or structural alterations

or damage of the brain can be demonstrated; otherwise MBD may only be inferred by symptoms. The pragmatic view is favored by Clement when:

With our limited validated knowledge concerning relationships between brain and behavior, we must accept certain categories of deviant behavior, developmental dyscrasias, learning disabilities, and visual-motor-perceptual irregularities as valid indices of brain dysfunctioning. They represent neurologic signs of a most meaningful kind, and reflect disorganized central nervous system functioning at the highest level. To consider learning and behavior as distinct and separate from other neurologic functions echoes a limited concept of the nervous system and of its various levels of influence and integration (Clements, 1966, p. 6).

The concept of MBD is used empirically in this study since it is an empirical usage that comes from clinical diagnosis. Essentially, diagnosis of MBD in the clinical situation suggests that behavioral or learning problems result from neurological impairment rather than from emotional problems, retardation, or impairment of sense organs, e.g., blindness. MBD is often diagnosed by abnormal EEG's by developmental histories, by neurological examinations, psychiatric examinations and by psychological testing. It is obvious that none of these examinations could be an actual verification of brain damage by direct observation; they are all symptomatic and define MBD by observation of impaired functioning.

Profile Analysis

A form of pattern analysis. From Wechsler (1958, p. 165).

the graphic representation of comparable test scores sequentially arranged in which the high and low points indicate high and low test performance on the tests in question. The form or shape

of the graph is then taken to give a "picture" of the characteristic idiosyncrasies of the individual's over-all test performance.

Special Symptoms not Elsewhere Classified 306

This category is for the occasional patient whose psychopathology is manifested by a single specific symptom. An example might be anorexia nervosa under Feeding disturbance as listed below. It does not apply, however, if the symptom is the result of an organic illness or defect or other mental disorder. For example, anorexia nervosa due to schizophrenia would not be included here (DSM II, 1968, p. 48).

Specific Learning Disorder 306.1

This refers to children who manifest an inability to learn because of impairment of ability to correctly process auditory or visual information or to correctly transmit information. This inability is usually caused by a central nervous system condition and is not the result of retardation, emotional disorder or sensory disorder.

Transient Situational Disturbances 307

This major category is reserved for more or less transient disorders of any severity (including those of psychotic proportions) that occur in individuals without any apparent underlying mental disorders and that represent an acute reaction to overwhelming environmental stress. A diagnosis in this category should specify the cause and manifestations of the disturbance so far as possible. If the patient has good adaptive capacity his symptoms usually recede as the stress diminishes. If, however, the symptoms persist after the stress is removed, the diagnosis of another mental disorder is indicated (DSM II, 1968, p. 48).

Wechsler Performance Subtests

Picture completion. Ability to note pertinent missing details in pictures of familiar objects. Requires knowledge of object and its structure or parts. Affected by visual-perceptual deficit.

Picture arrangement. Sequential arrangement of pictures in a cause-effect relationship. Requires social awareness, experiential background, noting of details, good visual perception, and common-sense awareness.

Block design. Ability to analyze and reproduce abstract designs with blocks. Requires gestalten recognition, ability to reduce to parts and to reconstruct. Essentially is problem solving with non-meaningful, visually presented symbols. Neurologically impaired learners often perform poorly on this subtest.

Object assembly. Part-to-whole construction of familiar objects. Requires organization, visual perception of details, and recognition of gestalt from minimal clues.

Coding. Copy of nonfamiliar, nonmeaningful symbols for familiar digits. Influenced by visual memory, eye-hand control, and ability to keep place visually.

Wechsler Verbal Subtests

Information. Memory of isolated factual data (details).
Dependent upon exposure. Remote memory.

Comprehension. Common sense; awareness of expected social responses. Judgment.

Arithmetic. Ability to hold details and solve orally presented arithmetic word problems (timed). Must have concepts, automatic number facts, and good auditory memory. Scores affected by anxiety or poor math knowledge. Ability to concentrate.

Similarities. Awareness of relationships. Quality of answers noted as concrete, functional, or abstract. Reflects information and thinking skills. Abstract verbal reasoning ability.

Vocabulary. Word meanings checked. Reflects concepts, information, and word fluency. Influenced by environment and training.

Digit Span. Ability to hold sequence and manipulate unrelated auditory stimuli. Forward sequence requires mainly repetition. Backward sequence requires visualization and recall. Test score easily influenced by anxiety. Measures ability to attend. (All performance subtests are timed.)

Summary

The purpose of this study is to analyze the ability of the WISC subtests to diagnose Minimal Brain Dysfunction by the use of different WISC diagnostic scoring patterns. Several different diagnostic scoring patterns are applied to two known groups, one of minimal brain dysfunction children and one of emotionally disturbed children. Using

a classification statistic, discriminant analysis, the diagnostic scoring patterns are evaluated simultaneously in order to see if the two known diagnostic groups of children can be differentiated. Each diagnostic scoring pattern is evaluated to see which can best distinguish between the two groups, and also how well the pattern can make the distinction.

Chapter 2

Review of Literature

Current conceptualizations of MBD come from 1) medical science, where this disorder is believed to be a mild form of epilepsy, aphasia, and related conditions, and 2) from psychology, where the student with an IQ in the retarded range who functions normally in some academic areas and most social areas is believed to show neurological dysfunction in those cases where emotional problems can be ruled out. At one time educators spoke of the MBD child as a poor reader, or a "lazy" child, or perhaps a hyperactive child. Because of the recent legislation requiring special education, MBD and learning disabilities in children are coming under closer scrutiny.

MBD and Guidance Movement

Much of the work and interest in MBD came from problems encountered in child guidance clinics after World War II. The child guidance movement in America was an attempt to help children within a psychodynamic frame of reference. However, play-therapy for the younger child and psycho-therapy for older children seemingly did little to help those certain children whose problems related to school performance (McCarthy, 1971). The home environment sometimes was considered to be the source of the child's "emotional block" to learning, and family therapy was instituted to help the child progress in school (Tarmopol,

1971), but the results were still not satisfactory. Strauss and Lehtinen (1947) suggested that learning problems and associated emotional disturbances might well be the result of a neurological dysfunction. More extensive diagnostic procedures such as the electroencephalogram validated the neurological dysfunction concept in children, and many children were found to exhibit neurotic behavior as an overlay of MBD (Tarnopol, 1971). At approximately the same time, the traditional mental health staff comprised of a psychiatrist, social worker, and psychologist changed from a hierarchical structure, where only the Psychiatrist would diagnose and treat by psychotherapy, to the present community oriented model where all staff members assist equally in a team approach. With the team approach, treatment changed from traditional psychotherapy to include family therapy and educational treatment such as that suggested by Strauss and Lehtinen (1947). The background to the study of MBD by Strauss and Lehtinen was suggested by earlier medical study of brain damage symptoms and syndromes.

The Strauss and Lehtinen Approach

Since organic brain disorders were found to affect a wide range of behaviors such as language, cognition, perception, motor coordination, emotional stability, activity level, etc., the next step was taken by Strauss and his associates (Strauss and Lehtinen, 1948; and Strauss and Kephart, 1955) when they suggested that all children showing disorders

in these areas were probably brain injured. Although this conclusion is debated now, it was important in suggesting that many behaviors thought to have emotional causes could be the result of minimal brain dysfunction. Strauss and Lehtinen (1947) emphasized the symptoms of distractibility, perceptual disturbances, thinking disorders and behavior disorders in what is now called the "hyperactive child" or has also come to be called the "Strauss syndrome." Although other types of brain-injured children have since been discovered, it should be pointed out that the "Strauss syndrome" child is not always the same child as the dyslexic, the aphasic, etc. The important point here is that Strauss and Lehtinen described education procedure for brain injured children who were hyperactive, distractible and "driven." Since the hyperactive child was believed to be abnormally responsive, a teaching method was developed to cope with this. The explosive release of emotional energies is a thalamic function that can be controlled by the higher cortical processes. With increased cortical control the brain-injured child can learn to modify his hyperactivity. From this theory, educational help was available in two ways: the environmental stimulation could be reduced with smaller class size, larger rooms, covered windows, etc.; the child could be taught how to exercise voluntary control by giving him academic and social success, stressing meanings and relationships and simplifying educational materials so the

child who is distractible, erratic, and perseverating can achieve success (Myers and Hammill, 1969).

The great popularity of the Strauss and Lehtinen (1947) approach came about because, except for Orton (1925), they were the first to offer educational principles and procedures that worked. The diagnosis of MBD and the associated treatment procedures gave hope to many parents with students in Special Education since it was the first recognition of the neurologically dysfunctional child.

Strauss and Lehtinen (1947) emphasized the importance of the diagnostic process, yet were not able to differentiate the various types of MBD. However their principle interest was in separating the MBD child from that child who was truly retarded or emotionally disturbed. In order to make the diagnosis they suggest:

A complete diagnosis of minor brain injury includes the following criteria:

1. A history shows evidence of injury to the brain by trauma or inflammatory processes before, during, or shortly after birth.
2. Slight neurological signs are present which indicate a brain lesion.
3. When the psychological disturbance is of such severity that a measurable retardation of intellectual growth can be observed, the immediate family history indicates that the child comes from a normal family stock and that he is, in general, the only one of the sibship so afflicted.
4. When no mental retardation exists, the presence of psychological disturbances can be discovered by the use of some of our qualitative tests for perceptual and conceptual disturbances.

Although the first three criteria may be negative, whereas the behavior of the child in question resembles that for brain injury, and even though the performance of

the child on our tests are not strongly indicative of brain injury, it may still be reasonable to consider a diagnosis of brain injury (Strauss and Lehtinen, 1947, p. 112).

Strauss and Lehtinen suggest that a brain injured group shows a great variety of brain defects such as perceptual versus conceptual versus behavior deviations. They then make the point that is still an issue:

With a few exceptions there does not exist at this moment a pattern or a type of response characteristic and specific for the brain-injured defective child on standardized tests of intelligence, academic achievement, and visuomotor performance (Strauss and Lehtinen, 1947, p. 103-104).

It is this issue that can be a criticism of all further studies that will be surveyed; it is an inescapable fact that there is no one test pattern for MBD. Perhaps it is only the fact that a child is having a problem with no known emotional causes, no problems in the environment, and no sensory defects which indicates some type of central nervous system problem in the child.

Problems of Diagnosing MBD with Psychological Testing

In the past there has been considerable debate (Yates, 1955 and Anastasia, 1961, p. 322) about the value of psychological testing in the diagnosis of MBD. More recently, these questions have been approached by better research designs that answer some of the criticisms of the past (Reitan, 1962; and Morf and Krane, 1973). There is redefinition of what is meant by MBD, more elaborate and sophisticated statistical techniques, and studies that attempt to diagnose MBD with

more than one test or score. The progress of the debate can be illustrated by the inspection of two studies that differ in their approach to the measurement of MBD.

The Paine, Werry and Quay Study

Paine, Werry and Quay (1968) studied a group of 97 children referred to a medical clinic because of suspicion of "minimal organic cerebral dysfunction." Excluded from the study were children with IQ's below 80, mental retardation, those with psychiatric problems only, or with epilepsy, specific dyslexia, or cerebral palsy. There remained a group of 83 children who had any one of the following minimum criteria for inclusion:

1. Abnormal neurological signs on physical examination (beyond mere clumsiness).
2. An abnormal EEG.
3. Psychological findings of the type seen in organic encephalopathies plus either excessive clumsiness or an abnormal EEG (Paine, Werry, and Quay, 1968).

In this study boys outnumbered girls by 3 to 1. The mean age was 8.4 and the age range was from 5 to 12 years. The authors noted that the subjects in their study were from affluent backgrounds.

Paine et al. had available complete medical histories, neurological exams, electroencephalographs (not all patients had EEG's), and psychological examinations including the WISC which was available for 34 to 83 children.

In their summary of the results the authors reported that histories of cerebral insults did not appear in 37 of 81 children, and that 59 percent of the patients had no detectable abnormalities on the electroencephalogram, but that of the 55 children that had psychological test material available 95% were described as having irregular performance such that not all tests were passed at the child's normal level of achievement.

The WISC subtests were gathered from 34 children. Other children were given the Stanford-Binet IQ. From psychological reports on both the WISC and Stanford-Binet, five measures were collected including irregularity of the subtests, difficulty with abstraction, perseveration, dyscalculia and short attention span during testing. The psychological data was not scored according to any established profile or pattern analysis, but instead the psychologist's opinions were used and the subtest scores themselves served as the other basis for analysis. One subtest pattern was used; the ratio of Verbal IQ to Performance IQ on the WISC.

Paine et al. factor analyzed the data hoping that the different historical and neurological data would show similar results. From a principle axes factor analysis using the vari-max rotation, it was found that there were seven different neurological symptom complexes. However, there was no single symptom complex that was correlated with the different psychological scores obtained. For instance, irregular

subtests correlated with abnormal EEG scores, but not with abnormal reflexes, perceptual deficit, motor uncoordination, abnormal paranatal history, later birth order, or abnormal prenatal history. The authors concluded there was a disappointing lack of correlation between different measures of MBD and that there is a complex matrix of dimensions underlying MBD. Their disappointment with the multi-dimensional nature of MBD led them to suggest de-emphasis on "minimal cerebral dysfunction" and concentration instead upon "adequate psychosocial and educational assessment and rehabilitative programs."

The above research suggests several interesting facts as well as research directions:

1. MBD is not a unitary syndrome but a multi-dimensional syndrome.
2. It is more fruitful to study MBD by psychoeducational assessment alone instead of making additional studies of neurological function apparently assuming psychological assessment will reveal only one type of MBD.
3. Paine, et al. appear to neglect the fact that "poor inter-correlations of medical-psychological and electroencephalographic findings" actually suggest further examination of clusters of different MBD patterns which their research demonstrated.
4. Little effort was made to use actual WISC scoring patterns

for MBD, and instead unreplicable opinions of psychologists or the scaled scores alone were used.

5. No attempt was made to use a control group of either normal children or a comparison group of children with emotional or other problems. Thus, there was no way to know if the measures used could distinguish between MBD and any other condition.

It will be useful to survey another study conducted, wherein some of the faults of the above study were eliminated.

The Mykelbust and Boshes Study

Mykelbust and Boshes (1969) made a study of minimal brain dysfunction using psychoeducational evaluation, ophthalmological data, electroencephalographic evaluations, pediatric neurological evaluations and a pupil rating scale. A total of 214 children were diagnosed as learning disabled and these were screened from a population of 2767 third and fourth grade children by means of a ratio of academic achievement to academic expectancy for learning. In this case, MBD was first diagnosed by educational criteria instead of medical-psychological assessment.

Groups were divided into Learning Disability Controls, Learning Disabilities, and Borderline Learning Disabilities. They then carried out a discriminant analysis of forty-nine varieties of the psycho-educational battery on the basis of electroencephalographic exams,

ophthalmological exams and neurological exams for MBD. Although they titled their study Minimal Brain Damage in Children, Mykelbust and Boshes set out to study the learning disabled child and his relation to MBD determined by procedures such as the EEG. They classified children having learning quotients (LQ) of 85 to 89 as "borderline learning disability" and IQ of 84 or lower as "learning disability." The ratio of academic attainment age to academic expectancy age yields the Learning Quotient.

$$\frac{\text{Attainment Age}}{\text{Expectancy Age}} = \text{Learning Quotient}$$

They then used either a verbal or performance IQ of 90 on the WISC as the lower level for cutoff, below which children would not be included in the study. Vision, hearing, or anxiety disturbance were grounds for dropping children from the study as having defects other than learning disabilities. However it was interesting that they felt somewhat uneasy about the elimination of children from anxiety because their procedures for doing this included only a single paper and pencil personality test. IQ's of the three groups were matched with one another.

When the learning disability and control groups were compared on the electroencephalogram and on the pediatric neurological exam, significant, but not high, relationships were found. However of the 49 variables of the psychoeducational battery, many sub scores of the WISC are able to make statistically significant distinctions by method of

discriminant analysis. Since the use of EEG's and neurological techniques are similar to the present study, these are interesting findings. However, no attempt was made to use pattern or profile scoring of the WISC.

The following conclusions and criticisms can be drawn from the Mykelbust and Boshes study:

1. Use of the concept of learning disability as measured by a Learning Quotient is equated to MBD as measured by EEG's, neurological exams and psychological exams.
2. Use of 90 as an IQ cutoff under which children were not studied is a great handicap as most educational psychologists feel it is the child with the IQ between 50 and 90 who is generally suffering most from MBD or learning disability and who should not be classified as retarded.
3. Use of discriminant analysis to predict learning disabilities, EEG abnormalities, ophthalmological difficulties, or neurological problems show that the WISC subtests have proved helpful in each case. The use of profile or pattern scoring of the WISC was not made, but would have proved helpful given the above results.
4. No attempt was made to develop a method to distinguish between MBD and emotional disorders which can be confused with one another.

From examination of the above studies the problems surrounding definitions and design of studies of MBD can be appreciated. The present study is advocating practical discrimination between two important groups seen by a school psychologist--those of students with emotional problems, and those with MBD. It is evident that MBD is often defined differently compared to a learning disability, but the degree to which they are related makes the study of one useful to the study of the other.

Tests for Diagnosing MBD

Although this study has concentrated on the diagnosis of MBD using only the WISC, other tests are also used for MBD diagnosis in children. Since MBD has many aspects, psychological tests must measure behaviors that can range from specific reading disabilities to learning disabilities in general, or from temper tantrums to explosive outbursts, or subtle combinations of emotional, intellectual and physical disabilities.

Herbert (1964), Hammill (1971), Bannatyne (1971), and Birch (1964) have reviewed the ability of different psychological tests to diagnose MBD and/or learning disabilities. Generally the use of a test battery is favored since different tests will measure different types of functioning. Herbert (1964) lists eight specific areas of disability related to MBD. However, it is only in the area of Intelligence that he discusses the WISC and profile analysis.

Some of the more commonly used tests discussed by Herbert (1964) and Hammill (1971) sample the following areas:

1. Perceptual Functions

Marble Board Test (Strauss and Lehtinen, 1947)

Bender Visual-Motor Gestalt Test (Bender, 1938)

2. Learning and Memory

The Visual Retention Test (Benton, 1955)

Memory-for-Designs Test (Graham & Kendall, 1960)

The Auditory Modality:

Walton-Black Modified Word Learning Test (White, 1959)

3. Motor Functions

The Rail Walking Test (Heath, 1942)

4. Attention

Continuous Performance Test of Brain-Damage (Rosvold, Mirsky, Sarason, Bransome, and Beck, 1956)

5. Language

The Illinois Test of Psycholinguistic Abilities (Kirk and McCarthy, 1962)

Differential Language Facility Test (Sievers, 1959)

6. Concept Formation

Goldstein-Scheerer Color-Form Sorting Test (Goldstein and Scheerer, 1941)

7. Intellectual Functions

WISC (Wechsler, 1949)

8. Combinations of Tests

This includes many of the above tests analyzed together using a discriminant analysis statistic.

Herbert (1964) oriented his review toward brain damage in children although (MBD) is implied. He felt that the object of testing was to aid the psychiatrist in diagnosis of brain damage in children. But more fundamentally, he asked whether the concept of brain damage as a clinical entity was useful. In his conclusions, Herbert suggested that the tests are not as reliable and valid as they should be because there is not a "brain injured child" but actually a variety of brain-injured children whose problems, and therefore test behaviors, are quite varied. He called for more "development and application of tests which describe the various psychological deficits resulting from brain-injuries and which have implications for the academic and social training of the child" (Herbert, 1964).

Other summaries and uses of test batteries for diagnosing brain damage in adults are found in Rapaport, Gill and Schafer (1968), Russell, Neuringer and Goldstein (1970), Burgemeister (1962), Schulman, Kaspar and Thorne (1965).

The authors reviewing the use of different tests or test batteries to diagnose MBD or brain damage generally sort themselves into several different but compatible groups. Herbert (1964), and Schulman, Kaspar and Goldstein (1970) note that there is little research

support for a single clinical entity of brain damage. Birch (1964) and Burgemeister (1962) give clinical examples of test patterns in different MBD or brain damage syndromes. Hammill (1971) and Bannatyne (1971) propose the importance of education remediation for learning disabilities and MBD. Russell, Neuringer and Goldstein (1970) offer a research based computer program to predict the degree and location of different types of brain damage in adults. It would seem then that the attempts to speak of MBD as a single entity are actually attempts to set up a straw man for argument. However, the basic point of the present investigation revolves around distinguishing between emotional and MBD problems in order to determine the need for counseling or for further investigation and remediation as to the type of MBD or learning disability. From arguments in the literature it seems that the different MBD syndromes confuse counselors and school psychologists, especially when they are taught in testing courses that some profiles on the WISC suggest MBD when in actuality there are probably many such profiles. Thus the use of pattern analysis demands a great deal of testing experience.

The Diagnosis of MBD with Intelligence Tests

The first large scale use of psychological tests was started in 1904 by the French government when they asked Binet to construct a test to study subnormal school children (Anastasi, 1961, p. 10). It is probable that many of the children who performed poorly on this IQ test

did so because of MBD, but little attention was paid to this syndrome as an explanation of impaired IQ test performance.

The use of the Stanford-Binet intelligence test (Terman, 1916), the Gesell Development Inventory (Gesell, 1949), and the Wechsler Intelligence Scale for Children (Wechsler, 1949) were directed toward the measurement of the child's mental age so that it could be compared to the chronological age. The purpose of this comparison was to arrive at a ratio which would reveal a developmental lag in the children tested. However, it became apparent that the measurement of mental age would fluctuate depending on the test item, i.e. language skills, motor skills etc. Some tests, such as the Stanford-Binet, combined all the scores to produce one score for the IQ.

The difference in IQ test items was apparent in the Stanford-Binet Intelligence Test which was made up of a variety of items including vocabulary, motor tasks such as stringing beads, and explaining the meanings of proverbs. Each task was age graded to be used in determining the mental age of the child. However, many children would pass test items at one age level but were not able to pass other test items at the same level. The difference in performance on the various test items gave an average mental age that was inconsistent with the mental age yielded by any of the individual test items.

This uneven performance on various IQ test items also had its reflection in the responses of adults who suffered from mental

deterioration. The mental deterioration could be temporary or permanent, caused by old age or general paresis (a syphilitic central nervous system degeneration). Babcock (1938) studied mental deterioration with the hypothesis that "old learning lasts practically unimpaired, except possibly for slowness of response, while ability to fixate new impressions shows weakness in varying degrees according to the degree of deterioration." She was then able to demonstrate this hypothesis by comparing parietic patients with a normal control group. The test she found to reflect "old learning" was the vocabulary test, which she felt required only previously formed associations. The tests that emphasized new learning and speed consisted of tasks such as remembering groups of digits or drawing designs from memory. Approximately 24 different tasks were used, some of which had been taken from the Army Performance Scale (Yoakum and Yerkes, 1920), and from commonly used medical tests such as naming cities, knowledge of the correct date, etc. Her use of the concept of "scatter" or differential profile, was in this case the old learning versus the new. This approach had already been in use for 15 years and was derived from the use of the IQ test itself. That is, a norm was established which was the chronological age (CA), and the subject's ability to pass tests at given age levels produced a mental age (MA) performance level. Thus $MA/CA=IQ$ (intelligence quotient), and for Babcock this was the "mental efficiency/peak level of earlier learning ability" which equaled the degree of mental deterioration. Babcock tried to establish

a ratio such that an individual's worst and best performance could be used to diagnose his mental deterioration, whereas the IQ ratio judged his overall performance in comparison to a normative group. This intra-individual diagnosis was to continue with Wechsler's further elaboration of deterioration ratios. The difference between measurement of IQ, brain damage, and minimal brain dysfunction had much of its beginning with Babcock and Wechsler's work. The further development of patterns or "scatter" analysis was made possible by Wechsler's development of the Wechsler-Bellevue intelligence test.

The Wechsler-Bellevue, WAIS and WISC were designed around two concepts that made them superior for some purposes to the Stanford-Binet Intelligence Test. Wechsler did not measure IQ by a ratio of mental age to chronological age, but rather used normative groups for different age levels. He used the amount of deviation of an individual's score from his normative group to indicate the IQ. Wechsler did not use age-specific tasks as Binet did but, in the WISC, used twelve different tasks or subtests which were broken down into problems of various levels of difficulty. For example, in the Digit Span task he first requires the subject to successfully remember three random digits, then four, then five, . . . until the final level of difficulty which is nine random digits. Wechsler found empirical norms for every four month interval between five and fifteen years of age for each subtest task, and then he scaled this into a standard form with a mean

score of ten points and a standard deviation of three points. The scaled subtest scores are added and converted into a deviation IQ with a mean of 100 and a standard deviation of 15. By this method the Verbal, Performance and Full Scale IQ's can be scored. The net result of this approach was that clinicians could compare the subject's individual strengths and weaknesses on the scaled subtests, and it was quite natural to look for subtest patterning. If one inspects Figure 1 (page 8) the interesting similarities and discrepancies in the WISC profiles would certainly generate some hypotheses in the clinicians mind. He could then check these hypotheses with other tests, inquire into the family background, or perhaps make a referral to the family doctor or health professional, or finally, he would obtain extensive consultation with school authorities regarding the educational program that might be chosen for this child.

With the advent of pattern analysis as a clinical tool, and the publication of the WISC in 1949, the stage was set for the development of patterns for the WISC or for the use of patterns already developed for the WAIS.

Clements and Peters' MBD Patterns

Ackerman, Peters, and Dykman (1971) conducted a study of 82 children with learning disabilities and 34 controls with the objective of comparing WISC patterns suggested by Clements and Peters (1962).

They found the learning disabled children scored lower than the control group on Arithmetic, Digit Span, Information, and Similarities. There was also evidence for impairment in Verbal IQ for the learning disabled child especially those with reading disorders. However, it was concluded that the learning disabled child may often have no signs of MBD as measured by a special neurological exam and thus the lack of support for some of the WISC MBD patterns suggested by Clements and Peters (1962) may result from differences between syndromes.

Wechsler's Brain Damage Profile

Wechsler believed that his IQ tests provided considerably more diagnostic information than a simple IQ score. He developed the idea that some tests do not change with age whereas others do, so that a deterioration index can be developed. The greatest clinical impact came from his second concept that different forms of psychopathology (e.g. chronic alcoholism, general paresis, organic brain disorder, etc.) produced differential effects on the Full Scale, Verbal, and Performance IQ's, as well as on the subtest scores. Matarazzo (1972, p. 430) has pointed out that, of the hundreds of studies conducted between 1940 and 1970, there was little reliable evidence as to the usefulness of profile, pattern, and scatter analysis. He suggested the problem was the inability of investigators to replicate their findings using cross validation because of the unreliability of the criterion (the

type of psychopathology involved). Many investigators could not agree as to whether a patient suffered from a schizophrenic reaction or hysteria (Matarazzo, 1971).

There were other problems presented by profile analysis that perhaps present greater problems. Investigators have had a hard time mathematically scoring the profiles of patients to compare them to the various Wechsler patterns, so they would subjectively score the patterns. Various authors such as Meehl (1954) were quick to point out the problems of subjective diagnoses from profile patterns. Some investigators such as DuMas (1949) did attempt mathematical scoring of profiles so they could compare individual subtest scores between diagnostic groups with t-tests (Graham, 1952). Considering the problems of reliability of the subtests, the labor involved in using sophisticated mathematical methods of scoring, and the problems of cross-validation, it is natural that clinicians continued with the use of subjective scoring methods, and they developed a general impression that profile diagnosis was too difficult to research.

For reasons cited above there are no examples in the research literature using Wechsler's brain damage profile as a "pattern" or as one of several profiles for brain damage diagnosis. Thus, this study presents an opportunity to develop scoring methods for profiles and to evaluate them using discriminant analysis in order to develop prediction equations for MBD.

McGlannan's Two Dyslexia Profiles

WISC profiles that are correlated with reading disorders (dyslexia) have been a popular subject of research (Zimmerman and Woo-Sam, 1972). The search for WISC subtest patterns that correlate with reading disorders has had three objects: 1) to be able to distinguish normal children from children with dyslexia or reading disorders, 2) to be able to determine the severity of the disorder, and 3) to be able to relate WISC patterns to the child's ability to respond to remediation. However, there is controversy about what types of reading disorders exist and authors such as Bannatyne (1971) report different syndromes, e.g. genetic dyslexia and minimal neurological dysfunction dyslexia.

The association of dyslexia to MBD seems to be a function of the severity of the dyslexia. For example, McGlannan (1968), in his studies of genetic dyslexia includes specific dyslexia which "encompasses those children who demonstrate affirmative conceptual ability and unimpaired inferential reasoning in spite of their demonstrable auditory and visual perceptual handicaps." Another type of genetic dyslexia is associated with MBD and is termed complex dyslexia which "encompasses those children who demonstrate the genetics of dyslexia, but have, in addition, been subjected to minimal insult or trauma resulting in deficits in association, conceptualization and retention" (McGlannan 1968). Research supports the notion that the concepts of

dyslexia and MBD are closely associated (Bannatyne, 1971; Black, 1973; and Levine and Fuller, 1972).

The inability of researchers to distinguish between reading disorders and emotional disturbance using the WISC was demonstrated by Graham (1952) when he found no difference between WISC reading disorder profiles and Wechsler's profile for the adolescent psychopath. Other authors (Bannatyne, 1971) readily admit the emotional problems produced by learning disorders are a source of conflict when analyzing research results, and McGlannan (1968) in his development of the two dyslexia profiles was careful to exclude children with emotional problems from the sample. It is felt that much of the variability in dyslexia research, as it is with MBD in general, is the problem of multiple dyslexia syndromes as well as distinguishing it from emotional problems. McGlannan's two dyslexia patterns seem to be the best researched, although Huelsman (1970) and Kender (1972) have reviewed the literature and suggest WISC profiles that are different from McGlannan's (1968). Thus, work is needed to see if McGlannan's patterns can provide a differential diagnosis between the child with MBD and the emotionally disturbed child.

An Experimental Profile

As in the study of Wills and Banas (1971) many profiles are noticed in clinical work that must be validated in research studies. The experimental profile was derived from noticing that some children

had auditory encoding problems, especially those between 7 and 11 years of age. These children seemed incapable of holding the auditory input in storage long enough to be able to encode it. They could hold numbers in auditory storage such as in Digit Span, so that it was actually the problem of meaning or encoding rather than auditory storage that presented the difficulty problem. No research was formally carried out with this pattern, although other clinicians noticed the same phenomena when it was brought to their attention.

Bannatyne's Patterns for Learning Disabilities

Bannatyne (1971) tried to develop a procedure for re-analyzing the WISC results of dyslexic children. He felt that the "genetic dyslexic child" (a child who tends to inherit a predisposition for reading problems) should be distinguished from the child who has reading problems due to emotional disorder ("primary emotional communicative causes"). These children should also be distinguished from children who have reading problems associated with minimal neurological dysfunction, as well as from children whose reading problems are caused by social, cultural or educational deprivation (Bannatyne, 1971, p. 591).

Bannatyne believed that the genetic dyslexic child would obtain a higher than normal score in Spatial Abilities, do less well or average in Conceptualizing Ability and poorly in Sequencing Ability. He also reported a study of 87 dyslexic boys that supports this relationship. Bannatyne believed that the child with minimal neurological

dysfunction would score lowest on either Sequencing or the Spatial Abilities test items (Bannatyne, 1971, p. 222).

Rugel (1974) reviewed 25 studies which reported WISC subtest scores for disabled readers. It was found that most poor readers were strongest in Bannatyne's WISC pattern for Spatial Abilities, intermediate in Conceptual Abilities and weakest in Sequential Abilities. The evidence in support of Bannatyne's patterns seems positive in the case of genetic disabled readers but little support has been given for his category of the neurologically impaired reader.

Because of the interesting results found in Bannatyne's research in reading disorders it is felt that it would be valuable to see if it could distinguish between MBD and emotionally disturbed children.

An Adaptation of Money's Factor Analytically Derived Patterns

Cohen (1959) factor analyzed childrens' WISC scores. To control for any possible effect of test age upon factor loadings, he used 3 age groups in his samples. He found loading on 5 groups of subtests. He labeled these Verbal Comprehension I (Information and Similarities), Verbal Comprehension II (Vocabulary and Comprehension), Freedom from Distraction (Digit Span), Perceptual Organization (Block Design and Object Assembly) and found a Quasi-factor measured by Coding. Money (1962) suggested that use of these factors could identify areas of learning disability. He adapted the factors into three areas: 1) Perceptual Organization (Block Design and Object Assembly), 2) Freedom

from Distractability (Arithmetic and Digit Span), and 3) Verbal Comprehension (Information, Similarities, Vocabulary and Comprehension).

After consultation with school psychologists, an adaptation of Money's Verbal Comprehension pattern was made for the present study. This adaptation employed only the Information and Comprehension subtests.

Money (1962), in his use of factor analytically derived patterns, assumes that the test performance of children with MBD or learning disabilities will show the same WISC pattern as the standardized sample upon which Cohen based his analysis. There is some evidence against this assumption when the factor analytic structures by normal and retarded children are compared, (Baumeister and Bartlett, 1962a; 1962b; and Osborne and Tillman, 1967).

Differences were found between factor analytic structures of learning disabled children (Leton, 1972) compared with Cohen's (1959) factors with normal children. However, Zimmerman and Woo-Sam (1972) reviewed WISC studies between 1960 and 1970 and found more agreement than disagreement among factor analytic studies, especially when Cohen's (1959) study was used as a reference point.

There has been little research use of Cohen's (1959) WISC factors or Money's (1962) adaptation. However, Klatskin, McNamara, Shaffer and Pincus (1972) have recently used Cohen's original factors and found the Perceptual Organization and the Quasi-factors to be significantly related to neurological signs of MBD in children of

average intelligence. Thus, it appears that these subtest patterns can be predictive of MBD even when Full Scale, Verbal and Performance IQ's are not significantly different.

Wills and Banas Three Learning Disability Profiles

Wills and Banas (1971) suggested the use of 3 MBD profiles. These were derived from a clinical approach used in connection with results from complete diagnostic work-ups. Although they represent no research results, such clinical findings are useful in furnishing hypotheses for research. Their approach makes use of a "careful subjective evaluation" of each subtest. For example, their "vulnerable child" presents the picture of "the dyslexic child who has trouble with the use of symbols but has strength with meaningful material." Thus, "his good thinking skills, as seen in his Similarities and Block Design scores, are limited by the inability to hold unrelated stimuli, as in Information and Picture Completion." For real evaluation of profiles based on clinical intuition, much "hard" research verification is required.

Reitan's Verbal-Performance IQ Patterns

The use of Verbal-Performance IQ differences has been one of the more common clinical indices of psychological or neurological dysfunction. Reitan's work suggested that for adults with brain damage localized on the left hemisphere, the Verbal IQ is lower than

the Performance IQ; when damage is to the right hemisphere the Performance IQ is lower than the Verbal IQ (Matarazzo, 1972, p. 385). However, when children were tested with the WISC, Reed and Reitan (1969) and Pennington, Galliani and Boegele (1965) found no differences between localization of brain damage and Verbal-Performance differences. They did find that brain damaged children always had lower Full Scale, Performance and Verbal IQ's which is not always true in adults. Reed and Reitan (1969) suggested that a possible explanation for their results would be that the brain damage had occurred before intellectual abilities had become differentially lateralized.

Other studies have confirmed the Verbal-Performance IQ difference in lateralized brain-damaged children in epileptic children (Fedio and Mirsky, 1969), and in neurologically impaired children with reading disorders (Black, 1973). In addition, Bortner, Hertzog and Birch (1972) report a lower Verbal than Performance IQ in "educationally designated brain-damaged children" who had fewer signs of central nervous system dysfunction than did another brain-damaged group who did not show the Verbal-Performance IQ difference. The literature in this area suggests that use of Verbal-Performance IQ differences occasionally indicate MBD, but there are groups of lateralized brain damaged children that do not exhibit Verbal-Performance IQ differences.

Criticisms of WISC Pattern Analysis in the Diagnosis of MBD

There are several authors who have made constructive criticisms about how the WAIS and WISC, and other psychological tests, should be used in diagnosis. Generally the criticisms refer to the problems of reliability and validity of clinical versus statistical predictors on the WISC. More recently the question of criterion measures for evaluating the validity of scoring patterns has become important.

Anastasi (1961, p. 322) first cites the usual criticisms of the WAIS and even more of the WISC, stating that the reliabilities of the subtests such as Information, Comprehension, etc. are not high enough to permit confidence in interpretation of any but the largest differences. For example, an article on reliabilities of subtests by Hopkins and Michael (1961) sets the difference between Information and Comprehension of 4.1 points as significant at the .05 level, and a difference of 7.6 points as significant at the .01 level of significance.

The WISC is sometimes used as a differential aptitude battery. However, such a battery requires high reliability of the individual subtests and low correlations between these subtests since each subtest should measure a separate skill. Anastasi (1961) points out that the WISC contains fairly high correlations between subtests in the normal population. The argument is made that in abnormal populations WISC scatter or profile differences are found. This illustrates the potential of the WISC as a diagnostic tool in a differential aptitude

battery. Anastasi then points out that due to the number of possible interest comparisons (with 11 subtests yielding 55 comparisons) there would occur 5.5 significant differences at the .10 level of significance in a normal population.

The problem concerning the number of significant differences found in a normal population was answered by Wechsler (1958, p. 165) who suggested that it is the unique combination of subtests that is important and not so much the question of reliability. Wechsler points out that a unique pattern of scores is one in 175,000 if one starts with 10 tests and 3 dichotomies where a subtest is greater than, equal to, or less than the average subtest score.

Anastasi (1961) suggested that studies of various diagnostic score profiles, especially using the WAIS and Wechsler-Bellevue, have generally failed to prove the hypotheses behind the score profiles. Rabin and Guertin (1951), and Guertin, Frank and Rabin (1965) found in their reviews of the Wechsler-Bellevue Intelligence Scale, that the failure of various profiles could be explained by comparisons of pathological and control groups who were not equated in terms of education, age, or other relevant variables. Anastasi (1961) also suggested that profiles were derived from uncontrolled clinical observation and there was failure to cross-validate the studies.

The use of diagnostic profiles in mathematically scored forms with norms, or as inferential "signs" by school psychologists, has

also produced controversies. Because of the failure or complexity of the mathematical forms of profile analysis, many counseling and clinical psychologists have diagnosed MBD by using diagnostic WISC profiles only as "signs" on which to base their clinical judgment.

Meehl (1954) introduced the problem of statistical versus clinical prediction. It has been found that statistical methods of diagnosis produce greater accuracy than that produced by a clinician who sits down and inferentially evaluates a group of clinical test scores (Meehl, 1965). However, in order to develop good statistical prediction, clinicians have to offer their ideas on the various patterns for diagnosis, and then the statisticians can study these factors to determine their statistical value in differentiating known diagnostic groups (Wechsler, 1958, p. 167). Many of the diagnostic patterns that clinicians propose are not easily found by statistical method since the number of possible patterns turns out to be nearly infinite. It was the intent of this study to statistically validate some recently proposed clinical patterns.

Yates (1954), in his survey of the validity of some psychological tests of brain damage, offered four criteria as to how validity should be measured. First, the test must distinguish between brain-damaged, emotionally disturbed and normal groups. Secondly, the data should be presented in such a form that the clinician using the form can estimate the degree of possible error in diagnosis. That is, an

optimum cutoff point should be stated such that 1) as many brain damage cases as possible should be identified, 2) as few emotionally disturbed and normals as possible should be misclassified, 3) the point beyond which no emotionally disturbed or normals are found, and 4) the point beyond which no brain damaged patient is found. And thirdly, Yates (1954) suggests cross validation with new groups independent of the original criteria groups. Finally, Yates suggests factors such as age, sex, and intelligence should be controlled for in the many tests that do not have norms on these factors.

Reitan (1962), Yates (1966), Zimet and Fishman (1970) and Matarazzo (1972) have all reviewed the literature on the diagnostic uses of pattern analysis on the WAIS and WISC. Their conclusions suggest two courses of research because of the many different syndromes of brain damage and MBD. On one hand, Reitan's research program (Matarazzo, 1972, p. 382) has very carefully verified by neurological means the exact type of brain damage in adult patients and then has used these carefully selected criterion groups to validate a test battery. On the other hand, Reitan himself (Reitan, 1962) notes the problems of the study of MBD in children since actual neurological destruction of tissue is not evident. In order to deal with this problem Reitan recommends the use of discriminant analysis so that a number of tests may be simultaneously used to sample the different types of MBD patterns.

The Performance of MBD and Emotionally Disturbed Children on the WISC

Use of the WISC to distinguish between MBD and emotionally disturbed children is important since it is usually the first test given by a school psychologist or counselor to determine further diagnostic work. There is a paucity of studies in this area and the major reason probably relates to the inability of investigators to demonstrate differences between the two diagnostic groups. Differences between these groups are obscured by the greater dispersions of test scores in the emotionally disturbed (Maxwell, 1961, and Wechsler, 1958, p. 163) and in those with brain dysfunction (Wechsler, 1958). Thus error variance is increased and the true variance is obscured.

Although reports of negative results are rarely found in the literature due to reluctance of investigators to report these results, Rowley (1961) found no differences between a group of 30 children with a diagnosis of brain damage and a group of 30 children with a diagnosis of emotional disturbance. The subjects were individually matched with respect to sex, chronological age and WISC Full Scale IQ. A minimum IQ of 83 was established to exclude defective children. There was no significant difference between the groups on the Verbal IQ or the Performance IQ. The Verbal-Performance relationship within each group did not distinguish between the groups. In addition, the profiles of subtest scores in the two groups were not significantly different and none of the individual subtest scores showed a significant intergroup

difference. Rowley (1961) reached the conclusion that when Full Scale IQ's are controlled for, the pattern of WISC performance will not distinguish between emotional and brain damaged groups. The problems with Rowley's research concern his assumption of a single brain damage entity and thus his failure to use a discriminant analysis of the several scores he provides. In addition, one of the educational conditions encountered is that there is generally an IQ difference between emotional and brain damaged group averages and this should be considered as part of the diagnostic procedure.

Caputo, Edmonston, L'Abate, and Rondberg (1963) were able to confirm the fact that brain damaged groups have, as an average, lower Full Scale, Verbal and Performance IQ's than the emotionally disturbed groups. Picture Completion scores were lower in a brain damage group than in an emotionally disturbed group. Lowered scores on the Block Design and Digit Symbol subtests, while apparently sensitive to brain damage, did not distinguish this syndrome from emotional disturbance. Thus it is probably the general case that lower IQ's are one of the better indicators of brain damage compared to emotional disturbance.

Hall and LaDriere (1969) were able to find differences between 120 emotionally disturbed and 120 brain damaged children on specific items in the Similarities subtest using an error analysis approach. The individual items in the Similarities (items 1 through 16) were scored as to the types of incorrect responses that could be made such

as vague responses, descriptive responses, a "I don't know" response, no attempt to answer, and denials of the existence of a correct answer. It was found that brain damaged children tended to deny the possibility of a correct answer, while emotionally disturbed children made errors of inadequate conceptualization. However, when using the number of right and wrong responses on the Similarities subtest, no difference between brain damaged and emotionally disturbed children could be found. As in the Rowley (1961) study, Hall and LaDriere (1969) matched their emotionally disturbed and brain damaged groups as to sex, chronological age, and WISC Full Scale IQ. Thus lack of results other than those of error analysis of Similarities again point out the essential lack of other WISC differences between emotional and MBD groups when IQ is controlled for.

Bortner and Birch (1969) surveyed patterns of intellectual ability in emotionally disturbed and brain-damaged children who were in special schools that provided services for these children. Only about 50 to 60 percent of the children who had been diagnosed MBD or emotionally disturbed had been sent to these schools. The children studied ranged from age seven to age eleven, with 131 in the emotionally disturbed group and 116 in the brain damaged group. Only chronological age matching was carried out. Bortner and Birch (1969) concluded that their data suggest that the intellectual organization in emotionally disturbed and brain damaged children is markedly similar when IQ level

is controlled for. There were differences found in factor analytic structure between normals, emotionally disturbed and brain damaged. However, WISC profiles were essentially the same between groups. Bortner and Birch (1969) note that the diagnostic process was such that these children diagnosed as emotionally disturbed may have been in fact brain damaged and therefore the study was biased to that extent.

The difficulties with the Bortner and Birch (1969) approach are several; the controlling of the Full Scale IQ obscures differences between the groups that are part of the natural educational situation and in part provide for the ability of tests to distinguish between emotional and brain damaged groups. Another way of making this point is to notice that the factor analytic approach was able to distinguish between the groups. If the authors had used a discriminant analysis, or other types of multivariate analysis, the amount of error variance could be reduced and thus there could be improvement in the ability to detect real differences. When one variable is analyzed at a time, the misconception is made that MBD is a single syndrome and not a group of syndromes. Also, other than looking at the Verbal-Performance differences, Bortner and Birch (1969) made no attempt at testing a pattern approach to scoring the WISC.

The Scoring Philosophy of this Study

The usual approaches to WISC "scatter" or pattern analysis involve either 1) the use of profiles such as that proposed by Wechsler

where each WISC subtest is assigned a score supposedly typical of a certain diagnostic group, 2) the use of an analysis of intratest scatter such as in the Hall and LaDriere (1969) study wherein various types of errors on the Similarities test were analyzed, 3) the use of subtest ratios where certain subtest scores are mathematically compared with each other such as Verbal IQ vs. Performance IQ, or 4) ratios among subtest scores as suggested by Bannatyne (1971). There have been several problems associated with each of these approaches that present problems for clinicians.

Wechsler's profile analyses have presented problems of reliability, problems of validation against diagnostic groupings and difficulty of application; since the school psychologist must scan a number of diagnostic profiles to determine which profile most closely fits his client's test performance. Despite these problems, research continues to attempt to produce profile findings that are of a diagnostic value. Hartlage (1973) attempted to distinguish between three types of learning disabled children using the WISC: 1) those deficient in school achievement, 2) those with abnormal pediatric neurological evaluations, 3) those showing classroom behavior disorders. He found only the Object Assembly subtest of the WISC subtests able to differentiate the learning disability groups. These groups were the emotionally disturbed, brain injured, dyslexic, or those of dull normal intelligence. However, he found that 20 of 40 behavioral

variables were able to distinguish between groups. There is little significance in the WISC findings of this study for a clinician because differences observed in the Object Assembly test could be due to chance. There was no effort by the investigator to use multivariate procedures, to develop any kind of prediction equation, to assign patients to diagnostic groups, to use WISC scoring profiles, or to develop a profile for the WISC. Therefore, the WISC proved an inefficient instrument because the investigator did not use statistical and theoretical methods which would capitalize on the full range of potentialities of his instrument.

The use of intra-test scatter has not been a common technique in research literature. However, school psychologists and other psychometricians often do use it in an inferential way, making qualitative judgments of its significance. Because of lack of explicit scoring methods tests other than the similarities test (Hall and LaDriere, 1969) the technique has not been discussed in the present study.

Use of subtest ratios has been a popular research technique since the days of Wechsler's "deterioration" index (Wechsler, 1938). Several methods used in the present study, such as those of Bannatyne (1971) and Money (1962) are easily used by psychometricians and offer several indices of MBD or learning disabilities. Past use of WAIS ratio methods such as those of the Verbal vs. Performance IQ differential, on the Hewson ratios, have presented mixed results (Fisher

and Parsons, 1962; Matarrazo, 1972). However, continued use of ratios is encouraged by the fact that they are easy to score and norms for predictions are easily developed.

The approach of the present study is in agreement with the Yates (1954) criteria for validity. However, before the test patterns can be analyzed they must be scored in a reproducible mathematical form.

The scoring method chosen for the different MBD WISC profiles is that of Pearsons product-moment correlation coefficient. This test assumes a linear relationship between the MBD profile and the patient's test profile. It does not assume, however, that IQ levels will be equal. It is the general agreement in slope of the functions that must be established. In much of the literature, profiles are compared subtest by subtest by a t-test of significance such as that used in the Hartlage (1973) study. However, this technique does not exploit the value of a profile as a "pattern" and hence valuable diagnostic relationships remain undiscovered, due to the crude nature of the statistical analysis applied.

Scoring of the ratio methods such as Bannatyne (1971), Money (1962), Clement and Peters (1962), and Reitan (1962) is more direct, yet some assumptions had to be made, as the authors had not clarified their scoring procedure. In the case of Bannatyne (1971) and Money (1962) the various subtests that were supposed to measure spatial abilities were subtracted from the average IQ level of 100 to give

an MBD score. This technique makes these scores partially dependent on IQ so that a child with a Full Scale IQ of 85 would receive a higher MBD score than a child with a Full Scale IQ of 100 if the subtests had a flat profile with no scatter. However, since it is generally the case that MBD children do have lower IQ's than normal or emotionally disturbed, this fact should be reflected in the MBD scores.

Although the 24 methods of scoring MBD are complicated, it is felt they are appropriate in view of the point made by Meehl (1954) that statistical prediction is generally better than clinical prediction. With this scoring program (in Fortran) and the discriminant weights, along with the current development of mini-desk computers, the clinicians would be aided in the following ways; 1) formerly laborious computation methods can be easily and instantly performed, 2) many different scoring methods for MBD can be computed at once, 3) the clinician will have available norms and what the probability is of possible error in assigning a patient to a diagnostic group, 4) much of these data can be generated by the administration of a WISC IQ test, and finally, 5) automated assessment systems are gaining more popularity as counselors, school psychologists and clinicians devote more of their time to behavior change techniques and less to formalized assessment (Morf and Krane, 1973).

Chapter 3

Method

This is a study of children referred to a mental hygiene clinic in Butte, Montana, during a two year period (1970-72). The children of interest in this study were those who were given a clinical diagnosis suggesting either emotional disorder, or minimal brain dysfunction (MBD). These children all had a complete psychological evaluation including the WISC. The method of comparing results made use of a two group discriminant analysis, which is a multivariate statistical procedure that weights the various scores in terms of how well the scores can distinguish between children suffering from emotional disorders vs. those suffering from MBD. Eight major scoring methods were used, and some of these methods produced more than one score, thus some twenty four scores were produced from the childrens' WISC IQ's.

Population Description and Sampling Procedure

The population used in this study were 246 children between the ages of 5 and 16, who were referred to the Butte Mental Hygiene Clinic in 1970 through 1972. From this population, a sample of 113 children were selected that met the experimental requirements that are discussed in the following section. Of the 113 children selected, 76 received diagnoses placing them in the MBD category while 37 received diagnosis of emotional problems. The MBD group contained 52 males and

24 females. The emotionally disturbed group contained 22 males and 15 females. The average chronological age for the MBD group was 9.13 and the average age for the emotionally disturbed group was 11.13. The MBD group had an average Full Scale IQ of 94.6, a Verbal IQ of 93.68, and a Performance IQ of 96.19. The emotionally disturbed group had a Full Scale IQ of 106.16, a Verbal IQ of 105.21 and a Performance IQ of 106.

When the Bender was scored for brain damage using a cut off raw score of 6 on the Koppitz System (Koppitz, 1963), 65.6% of the MBD group had indications of brain dysfunctions compared with 13.5% of the emotionally disturbed group. The MBD group also had abnormal signs on 40 out of the 44 EEG's given, while the emotional group had abnormal signs on 2 out of 4 EEG's given. These and other data can be examined in Appendix A which includes IQ data and other coded data for the original population of 246 subtests. Data used for the analysis of the 113 subtests sampled has been listed in Appendix B.

It is assumed that the population in this study is similar to those children referred to other mental hygiene clinics and, in addition, would be representative of the more serious cases seen by school psychologists since the majority of the cases were referred by school systems in the seven county area serviced by the Butte Mental Hygiene Clinic.

Experimental Categories and Treatments

Subjects chosen for this study had a final clinical diagnosis of either MBD or emotional disturbance using the Diagnostic and Statistical Manual II (DSM II) of the American Psychiatric Association (1968). Diagnoses suggesting MBD were those described under the Organic Brain Syndrome categories: 309 Nonpsychotic, 306.1 Specific Learning Disorder, or 308.0 Hyperkinetic reaction of childhood. The clinical diagnoses resulted from the composite judgment of the professional staff working at the Butte Mental Hygiene Clinic. The staff consisted of two psychiatrists, one psychiatric nurse, two social workers and two psychologists. The final diagnoses were made at the time the child's case was closed, and the clinical diagnostic and treatment procedures were completed.

The diagnostic process used at the Butte Mental Hygiene clinic consisted of the inspection of the child's medical and social history, his psychological testing including the WISC, Bender, DAP, and the Rorschach. An EEG was often recommended, followed by a neurological exam based on the results of the EEG. An examination by the clinic psychiatrist was usually done and then drug treatment, family counseling, educational recommendations, or further medical referral was made. An MBD diagnosis was given if indicated by 3 or more of the following:

1. An abnormal neurological exam.
2. An abnormal EEG.

3. A medical history of CNS trauma.
4. An IQ in a normal range with severe problems in school work.
5. No evidence of severe emotional problems from the psychiatric examination, social history or psychological examination.
6. A psychiatric examination indicating perceptual-motor problems, or specific intellectual deficiencies.
7. Signs of organicity on the total psychological battery of tests.

The diagnoses suggesting emotional disturbance were those listed in DSM II (1968) under 300.00 Neurosis, 301-304 Personality Disorders and Certain Other Non-Psychotic Mental Disorders, 305 Psychophysiological Disorders, 306 Special Symptoms (excepting 306.1 Specific Learning Disturbance), 307 Transient Situational Disturbance, and 308 Behavior Disorders of Childhood and Adolescence (excepting 308.0 Hyperkinetic Reaction of Childhood or Adolescence).

Each child included in the sampling had a complete IQ test with the Full Scale, Performance, and Verbal IQ recorded. The eleven subscales recorded included Information, Comprehension, Arithmetic, Similarities, Vocabulary, Digit Span, Picture Completion, Picture Arrangement, Block Design, Object Arrangement, and Coding. Sampling was limited to those subjects with scores over 85 in Full Scale, Verbal, or Performance IQ. This measure was taken in order to eliminate subjects who

were diagnosed retarded. Only those children who were diagnosed as MBD or emotionally disturbed were included.

Method of Collecting Data

The data were gathered from the case files of the Butte Mental Hygiene Clinic. To preserve anonymity, only clinic case numbers were used for identification on the statistical recording forms. All WISC subtest scores were used plus Verbal, Performance and Full Scale IQ's. The WISC subscores were in standard or scaled form in order to control for age differences. The age and sex of each child was recorded. The final clinical diagnosis was given in the usual numerical form following DSM II.

Method of Analyzing Data

The analysis of the data involved two stages: (1) the various scoring methods were quantified and were applied to the WISC subtest scores; (2) the 24 different scores obtained were analyzed by two group discriminant analysis. The discriminant analysis involved the comparison of all 24 MBD scores at once, then the scores were analyzed using each of the selected scoring patterns. Finally each of the 24 MBD scores were analyzed individually. In the following sections the quantification of each scoring pattern is presented mathematically along with a reference to the Fortran program which scores the data.

The Scoring Patterns

In order to evaluate each scoring pattern suggested for the WISC it was necessary to describe each in its mathematical form. The scored data were put into the form of the data matrix C, where C (I,J) with I=1, and J=1 refers to the first MBD score (J), of the first subject (I). The equation below will show how the raw IQ data is related to the MBD scored data. The exact forms will be found in Appendix C written in Fortran IV language.

Those MBD scoring patterns using correlations between the ideal MBD IQ profile subscores given in Tables 1, 2, 5, and 6, and each subjects IQ scaled scores in the raw data will simply be indicated by the correlation coefficient (r_{xy}). For example, for subject #1 evaluated by McGlannon's Specific Dyslexia Equation #8, the scored MBD equation appears as follows:

$$C(1,8) = r_{xy} + 1.0 \text{ where } r_{xy} = \frac{(N\sum XY - (\sum X)(\sum Y))}{\sqrt{((N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2))}} \text{ and } N = 4$$

The values for X_1 are $X_1 = 6$, $X_2 = 8$, $X_3 = 11$, $X_4 = 8$ which are the values for McGlannon's complex dyslexia profile, while subject #1 had $Y_1 = 8$, $Y_2 = 6$, $Y_3 = 5$, $Y_4 = 9$. When computed, $r_{xy} = +.1$ or $C(1,8) = 1.1$ giving a slight positive relationship between the subjects' scores and McGlannon's scores for dyslexia. In this case subject #1 happened to be the first subject in the MBD group.

Reitan's Patterns

Reitan suggested two patterns as possibly indicative of MBD. One pattern suggested the Verbal IQ was greater than the Performance IQ (Equation 1). The other suggested the Performance IQ was greater than the Verbal IQ (Equation 2). In order to insure that the results were always positive numbers, 100 was added as a constant. In order to insure that the two patterns were both predictive of MBD, they were set together in Equation 24 such that any difference is squared.

1. Equation $C(I,1) = (\text{Verbal IQ} + 100) - \text{Performance IQ}$
2. Equation $C(I,2) = (\text{Performance IQ} - 100) - \text{Verbal IQ}$
3. Equation $C(I,24) = (\text{Performance IQ} - \text{Verbal IQ})^2$

Wechsler's OBS Profile

Wechsler's OBS profile was interpreted as in Table 1, (page 7). Each subjects' pattern was then compared to this pattern by the use of Pearson's product-moment correlation coefficient r_{xy} . The assumptions behind this scoring procedure were two-fold: 1) that there is a linear relationship between Wechsler's OBS profile and the child who has MBD; 2) that this relationship is not dependent upon IQ level as such, but rather upon the relationship between the subject's profile and Wechsler's profile; and 3) the resulting correlation coefficient is converted by addition of a constant, 1.0, to insure a positive result for ease in the computer programming.

3. Equation $C(I,3) = r_{xy} + 1.0$

Thus a perfect correlation will be 2.0 and a perfect negative correlation coefficient will be 0.0.

The Experimental Profile

Again, as in Wechsler's profile, the experimental profile presented in Table 5 (page 12) was compared to each subject's profile by a Pearson product-moment correlation coefficient and a constant of 1.0 was added to insure a positive number as a result.

4. Equation $C(I,4) = r_{xy} + 1.0$

The Wills and Banas Profile

The Pearson product-moment correlation coefficient was also used for comparison of Wills and Banas three MBD profiles in Table 6. The child's actual scores were correlated with the three MBD profiles and a constant was added as in equation #4.

5. Dyslexia equation: $C(I,5) = r_{xy} + 1.0$

6. Language Disability equation: $C(I,6) = r_{xy} + 1.0$

7. Neurologically impaired equation: $C(I,7) = r_{xy} + 1.0$

McGlannan's Two Dyslexia Profiles

McGlannan uses 4 subtests of the WISC for his profile. The correlation was examined between the subjects scores on Similarities, Digit Span, Block Design and Coding. Correlations are calculated with

$N = 4$ for scoring purposes. The constant of 1.0 was also added to these equations to give a positive number as a result.

8. Specific Dyslexia equation: $C(I,8) = r_{xy} = 1.0$

9. Complex Dyslexia equation: $C(I,9) = r_{xy} = 1.0$

Money's Three Patterns for Learning Disabilities

Factor analytic studies (Cohen, 1954) suggested to Money (1962) that there are three factors upon which various WISC subtests load. Each suggest a different type of learning disability. For scoring purposes, the average score of each of the WISC subtests that composed the factor was subtracted from the average IQ of 100.

In order to evaluate all the factors simultaneously, the results of all three factors are added together to form a fourth factor. The four patterns are calculated as follows:

10. Perceptual Organization Equation:

$$C(I,10) = 100 - \left(\frac{\text{Block Design} + \text{Object Assembly}}{2} \right)$$

11. Verbal Comprehension Equation:

$$C(I,11) = 100 - \left(\frac{\text{Information} + \text{Comprehension}}{2} \right)$$

12. Freedom from Distractibility Equation:

$$C(I,12) = 100 - \left(\frac{\text{Arithmetic} + \text{Digit Span}}{2} \right)$$

13. $C(I,13) = C(I,10) + C(I,11) + C(I,12)$

Bannatyne's Three Patterns for Learning Disabilities

Bannatyne (1971) suggested three patterns of WISC IQ subtests that would identify three areas of learning disabilities. As with the quantifications of Money's (1962) pattern, the average of the pattern of the subtests scores were subtracted from the average IQ of 100, and in a fourth equation the three pattern results were added together so as to evaluate the three patterns simultaneously.

14. Spatial equation:

$$C(I,14) = 100 - \left(\frac{\text{Picture Completion} + \text{Block Design} + \text{Object Assembly}}{3} \right)$$

15. Conceptual Equation:

$$C(I,15) = 100 - \left(\frac{\text{Comprehension} + \text{Similarities} + \text{Vocabulary}}{3} \right)$$

16. Sequencing Equation:

$$C(I,16) = 100 - \left(\frac{\text{Coding} + \text{Digit Span} + \text{Picture Arrangement}}{3} \right)$$

$$17. C(I,17) = C(I,14) + C(I,15) + C(I,16)$$

Clements and Peters' Three Patterns for MBD

Clements and Peters (1962) suggest three patterns, each designed of several components. The quantification of the patterns is as follows:

Pattern A Equations

$$18. C(I,18) = (\text{Sum of squared subtests}) - \left(\frac{(\text{Sum of subtests})^2}{11} \right)$$

- $$19. C(I,19) = \left[\begin{array}{l} \text{Information} + \\ \text{Comprehension} + \\ \text{Similarities} + \\ \text{Picture Completion} + \\ \text{Picture Arrangement} + \\ 10.0 \end{array} \right] - \left[\begin{array}{l} \text{Arithmetic} + \\ \text{Block Design} + \\ \text{Object Assembly} + \\ \text{Digit Span} + \\ \text{Coding} \end{array} \right]$$
- $$20. C(I,20) = \left[\begin{array}{l} \text{Comprehension} - \\ \text{Arithmetic} \end{array} \right] + \left[\begin{array}{l} \text{Picture} \\ \text{Completion} - \text{Block} \\ \text{Design} \end{array} \right] + 20.0$$
- $$21. C(I,21) = C(I,18) + C(I,19) + C(I,20)$$

Pattern B Equations

- $$22. C(I,22) = \left[\begin{array}{l} \text{Information} + \\ \text{Comprehension} + \\ \text{Arithmetic} + \\ \text{Similarities} + \\ \text{Vocabulary} + \\ \text{Digit Span} + 100.0 \end{array} \right] - \left[\begin{array}{l} \text{Block Design} + \\ \text{Object Assembly} + \\ \text{Coding} \end{array} \right]$$
- $$23. C(I,23) = C(I,22) + C(I,2)$$

Pattern C Equations. This pattern is identical to Reitan's equation #2 and its value was used in Pattern C as required such as in equation #23.

The Fortran scoring program for the above MBD patterns is in Appendix C. The data that was analyzed by this program is in original form in Appendix D. The scoring was carried out by this author on the Xerox (R) Sigma 7 computer at the Montana State University Computer Center.

Statistical Hypothesis

Statistical analysis using a two group discriminant analysis provided the following items of information: in section A, the MBD scores and their weightings are combined to test their usefulness in distinguishing between the emotionally disturbed and MBD criteria groups; in section B, each MBD score is statistically analyzed to test its ability to predict MBD; in section C, various groupings of scores that represent each researcher's diagnostic patterns relative to MBD were analyzed together to see if they would significantly distinguish between the emotionally disturbed and MBD group. Thus the various theories were classified as to whether they succeeded or failed at prediction. Finally in section D, the scores that successfully predicted MBD were analyzed in combination to find an empirically optimum group of scores for the prediction of MBD. The empirically optimum group of scores, together with the weighting coefficients and appropriate cutoff points furnished a prediction equation for future practical diagnostic work.

The first analysis was made for all 24 MBD scores where a two group discriminant analysis was run to see if the scores would be weighted to distinguish between the 76 MBD children and the 37 emotionally disturbed children. Using the .05 level of significance and the F test with 24 and 88 d.f. the hypothesis are given in section A.

Section A

1. $H_0: \bar{Z}_1 = \bar{Z}_2$
2. $H_a: \bar{Z}_1 \neq \bar{Z}_2$

The mathematics of the statistical procedures used in this section are found in the BMD Biomedical Computer Programs (1974, p. 211). Under the null hypothesis, H_0 , the mean $\bar{Z}$ of the weighted equations are equal. Under the alternative hypothesis H_a , the mean $\bar{Z}$ of the weighted equations differ at the .05 level of significance. For example the mean of the weighted equation for the MBD group 1, $\bar{Z}_1$ will not be equal to the mean of the weighted equation $\bar{Z}_2$, for the emotionally disturbed group, if a significant difference is found using the F test with $p \leq .05$.

The second section of the analysis evaluated each of the 24 scores. For example, the first analysis evaluated the MBD score from Equation #1, the first of Reitan's patterns. In this section (Section B) each comparison was labeled with the equation number of the MBD scoring pattern, and each comparison was made between $\bar{Z}_1$ of the MBD group and $\bar{Z}_2$ of the emotionally disturbed group.

Section B

<u>MBD Score Equation Number</u>	<u>Null Hypothesis</u>	<u>Degrees of Freedom</u>	<u>Alternate Hypothesis</u>
1	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$

MBD Score Equation Number	Null Hypothesis	Degrees of Freedom	Alternate Hypothesis
2	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
3	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
4	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
5	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
6	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
7	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
8	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
9	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
10	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
11	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
12	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
13	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
14	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
15	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
16	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
17	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
18	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
19	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
20	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
21	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
22	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
23	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$
24	$\bar{Z}_1 = \bar{Z}_2$	1, 111	$\bar{Z}_1 \neq \bar{Z}_2$

The third analysis, section C evaluates the ability of the various theories which use multiple scores to distinguish between MBD and emotional disorder. For example, the first comparison is made with

Equations 1 and 2, and then with 1, 2, and 24 representing Reitan's theory. With equations 1 and 2 taken together, it is believed that if there are two types of MBD, characterized by either a high Verbal IQ - Performance IQ differential or a high Performance - Verbal IQ differential, then both types of MBD could be distinguished this way. Equation 24 is added to ascertain the degree to which any discrepancy between Verbal and Performance IQ's could be found.

Section C:

<u>MBD Score Reitan's Theory Equation Number</u>	<u>Null Hypothesis</u>	<u>Degrees of Freedom</u>	<u>Alternate Hypothesis</u>
1, 2,	$\bar{Z}_1 = \bar{Z}_2$	2, 110	$\bar{Z}_1 \neq \bar{Z}_2$
1, 2, 24	$\bar{Z}_1 = \bar{Z}_2$	3, 109	$\bar{Z}_1 \neq \bar{Z}_2$
<u>Wills and Bana's Theory</u>			
5, 6, 7	$\bar{Z}_1 = \bar{Z}_2$	3, 109	$\bar{Z}_1 \neq \bar{Z}_2$
<u>McGlannan's Theory</u>			
8, 9	$\bar{Z}_1 = \bar{Z}_2$	2, 110	$\bar{Z}_1 \neq \bar{Z}_2$
<u>Money's Theory</u>			
10, 11, 12	$\bar{Z}_1 = \bar{Z}_2$	3, 109	$\bar{Z}_1 \neq \bar{Z}_2$
10, 11, 12, 13	$\bar{Z}_1 = \bar{Z}_2$	4, 108	$\bar{Z}_1 \neq \bar{Z}_2$
<u>Bannatyne's Theory</u>			
14, 15, 16	$\bar{Z}_1 = \bar{Z}_2$	3, 109	$\bar{Z}_1 \neq \bar{Z}_2$
14, 15, 16, 17	$\bar{Z}_1 = \bar{Z}_2$	4, 108	$\bar{Z}_1 \neq \bar{Z}_2$

<u>MBD Score Equation Number</u>	<u>Null Hypothesis</u>	<u>Degrees of Freedom</u>	<u>Alternate Hypothesis</u>
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Clements and Peter's TheoryPattern A

18, 19, 20	$\bar{Z}_1 = \bar{Z}_2$	3, 109	$\bar{Z}_1 \neq \bar{Z}_2$
18, 19, 20, 21	$\bar{Z}_1 = \bar{Z}_2$	4, 108	$\bar{Z}_1 \neq \bar{Z}_2$

Pattern B

2, 22	$\bar{Z}_1 = \bar{Z}_2$	2, 110	$\bar{Z}_1 \neq \bar{Z}_2$
2, 22, 23	$\bar{Z}_1 = \bar{Z}_2$	3, 109	$\bar{Z}_1 \neq \bar{Z}_2$

Pattern C

(pattern C is the same as Equation #1)

The fourth section, D, is an analysis of the most discriminating factors in order that an empirically optimal formulation can be reached.

<u>Equation Number</u>	<u>Null Hypothesis</u>	<u>Degrees of Freedom</u>	<u>Alternate Hypothesis</u>
5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 22, 23, 24	$\bar{Z}_1 = \bar{Z}_2$	15, 97	$\bar{Z}_1 \neq \bar{Z}_2$

Precautions Taken for Accuracy

The major problem for data recording is the number of times it is transformed from one form to another. For example, in the present study, data from the WISC form were transcribed onto a statistical IBM record form, then punched onto IBD cards, then re-punched and

transformed by a computer program onto another set of IBM cards, then a two-group discriminant analysis was performed. It is felt that the first two stages where hand work is done can create error so a print out of the first IBM and succeeding cards were compared to the original IBM sheets.

Summary

The ability of various types of profile scoring methods to successfully distinguish between two known diagnosed groups of children depends upon how well the methods can be applied. They must clearly and validly measure what they purport to measure. The problems and procedures outlined in this chapter cover the subjects, test procedures, means of diagnosis and means of applying the specific profile scoring methods.

Chapter 4

Results

The results of the different applications of the discriminant analysis are summarized in Sections A, B, C, and D in this chapter.

The total summary will be found in Appendix E for reference.

The results of the MBD scores can first be seen in Table 7 where the 24 MBD scores were applied to each of the clinically diagnosed MBD and emotionally disturbed groups.

Table 7
Means of MBD Scores for Clinically Diagnosed MBD
and Emotional Groups

MBD Equation Score Number	Mean for MBD Group	Mean for Emotional Group
1	97.4	98.9
2	102.51	101.08
3	.98	.95
4	1.09	1.17
5	1.08	1.16
6	.91	.83
7	1.05	1.14
8	1.12	1.36
9	.95	.86
10	90.79	89.04
11	91.04	89.16
12	91.44	90.16
13	273.27	268.36
14	90.52	88.79
15	90.69	88.79
16	90.96	89.68
17	272.17	267.27
18	68.23	66.32
19	102.57	103.97
20	21.17	21.38
21	191.97	191.68
22	126.13	131.24
23	228.64	232.32
24	298.96	187.84

The scoring equations for MBD were set up such that the larger the score, the more the possibility of MBD. However, inspection of the mean scores in Table 7 suggests that in several cases of the MBD scoring patterns, 1, 4, 5, 7, 8, 19, 20, 22 and 23 show a reversal of this pattern. These equations are considered in the overall analysis since they do distinguish between the MBD and emotionally disturbed groups.

Section A

When all of the 24 MBD scores were subjected to a two group discriminate analysis, it was found that the MBD scores were able to distinguish between the clinically diagnosed MBD and Emotionally disturbed groups at a significant level, with $p < .005$ for an $F_{.05, 24, 88} = 2.9$. The practical aspects of this can be seen in Table 8 from the number of correct assignments of children made by the linear equation derived from the maximized weighting coefficients:

Table 8

χ^2 Test of Independence Between Clinically Diagnosed Groups and MBD Score Groups

		Classification by Clinical Diagnosis		
		MBD group = 76	Emotional group = 37	
Classification by Discriminant Analysis of MBD scores	MBD	67	9	76
	Non MBD	9	26	37
		76	37	113

The results in Table 8 were analyzed for independence by χ^2 .

$\chi^2 = 42.67$ with 1 df which gives $p < .001$ which demonstrates a significant degree of association between Clinical diagnosis and diagnosis by MBD scoring.

Using Yates' (1954) recommendations regarding test reliability and estimates of possible error, the discriminant analysis yields individual Z scores ranging from $-.92742$ for non MBD to $-.82999$ for MBD. Using a cutoff point of $-.89700$, 68 out of 76 MBD patients (89.6%) will be identified correctly with an incorrect MBD diagnosis of 8 out of 75 (10.4%). The point beyond which no emotionally disturbed child should score is $-.86955$ and the point beyond which no MBD should score is $-.91586$. The mean Z score of the MBD group is $-.87666$ with a standard deviation of $.01682$. The mean Z score of the emotionally disturbed groups is $-.90613$ with a standard deviation of $.01438$. The discriminant function coefficients used above for weighting the 24 MBD scores listed in Table 9.

Table 9

Discriminate Function Coefficients for Weighting the 24 MBD Scores

1. .01995	9. $-.02488$	17. $-.03017$
2. $-.02581$	10. .01720	18. .00709
3. $-.04168$	11. .00222	19. .02388
4. $-.01606$	12. .00000	20. $-.01087$
5. .01991	13. $-.14761$	21. $-.01173$
6. $-.01877$	14. .01705	22. $-.10328$
7. .01319	15. .00418	23. .01128
8. .00028	16. .02393	24. .00403

Section B

Each of the MBD scoring patterns were analyzed separately and the results can be seen in Table 10 where the MBD equation number is the same as that in Chapter 3.

Table 10

Analysis of Each MBD Score Including F Values, Degrees of Freedom, Number of Wrong Assignments, and Significance Levels

MBD Equation Score Numbers	F Value	Degrees of Freedom	Wrong Assignments	Significance Level
1	.194	1, 111	25	n.s.*
2	.194	1, 111	25	n.s.
3	.16	1, 111	25	n.s.
4	.98	1, 111	25	n.s.
5	1.78	1, 111	25	n.s.
6	1.94	1, 111	20	n.s.
7	1.46	1, 111	22	n.s.
8	4.67	1, 111	20	p<.05
9	.56	1, 111	25	n.s.
10	12.49	1, 111	20	p<.005
11	10.93	1, 111	21	p<.005
12	7.41	1, 111	18	p<.01
13	20.29	1, 111	16	p<.005
14	16.23	1, 111	17	p<.005
15	11.86	1, 111	21	p<.005
16	11.02	1, 111	18	p<.005
17	24.81	1, 111	18	p<.005
18	.09	1, 111	26	n.s.
19	.46	1, 111	23	n.s.
20	.03	1, 111	23	n.s.
21	.001	1, 111	25	n.s.
22	3.47	1, 111	21	n.s.
23	4.26	1, 111	20	p<.05
24	3/26	1, 111	25	n.s.

*n.s.--non-significant

In Table 10, wrong assignments are those children who are given clinical diagnoses suggesting MBD, but whose MBD scores from the WISC classified them in the emotional group. This process of assignment is better seen by example in Table 9.

Section C

Since various theories proposed several different MBD patterns for the WISC, the group of patterns were analyzed together. These MBD patterns are listed together in Table 11 just as they were listed in Chapter 3.

Table 11

Analysis of MBD Scores Associated with Various Theories

MBD Equation Score Numbers	F Value	Degrees of Freedom	Wrong Assignments	Significance Level
1, 2,	.09	2, 110	25	n.s.*
1, 2, 24	1.07	3, 109	25	n.s.
5, 6, 7	1.12	3, 109	25	n.s.
8, 9	2.32	2, 110	21	n.s.
10, 11, 12	7.32	3, 109	19	p<.005
10, 11, 12, 13	5.39	4, 109	19	p<.005
14, 15, 16	8.33	3, 109	18	p<.005
14, 15, 16, 17	6.27	4, 109	18	p<.005
18, 19, 20	.29	3, 109	23	n.s.
18, 19, 20, 21	.22	4, 108	23	n.s.
22, 2	3.76	2, 110	18	p<.05
22, 2, 23	2.47	3, 109	18	n.s.

*n.s.--non-significant

It should be noted that only Money's, Bannatyne's and Clements and Peters' MBD patterns were significant. Furthermore, since Clements and Peters' predicts in the opposite direction, only Money's and Bannatyne's patterns are successful.

Section D

From preliminary analysis, a group of MBD scores for the WISC were chosen in order to produce an optimum group of scores to distinguish MBD from emotionally disturbed groups. These scores are listed in Table 12.

Table 12

Analysis of MBD Scores Thought to Produce Optimum Results

MBD Equation Score Numbers	F ratio	Degrees of Freedom	Wrong Assignments	Significance Level
5, 6, 7,				
8, 10, 11, 12,				
13, 14, 15, 16,	2.6	15, 97	13	p<.005
17, 22, 23, 24				

Summary

It was found in this study that Money's and Bannatyne's patterns do distinguish between MBD and emotionally disturbed groups.

Clements and Peters' Pattern B can distinguish between MBD and emotionally disturbed groups, as can McGlannan's Specific Dyslexia profile. However, both of these gave the emotional group the higher score for MBD which is a failure of their ability to predict MBD.

Chapter 5

Discussion

The discriminant analysis results of MBD scores in Chapter 4 demonstrate the usefulness of MBD WISC scoring patterns in distinguishing between clinically diagnosed MBD children and emotionally disturbed children.

Researchers have found few WISC differences between MBD and emotionally disturbed children (Zimmerman and Woo-Sam, 1972). However, this study took the view that those failures are the result of using single WISC subtests, not using MBD pattern scoring of the WISC, and ignoring WISC Full Scale IQ differences that will distinguish between groups. Looking at numbers of wrong classifications in Table 8, Table 10, and Table 11, the single MBD scores or groups of scores are inferior in their ability to distinguish between MBD and emotionally disturbed groups, compared to the 24 MBD scores.

It should be surprising that studies investigating one WISC profile at a time do not turn out to be significant. Unless the MBD population studied was carefully limited to a single syndrome such as severe genetic dyslexia in 8 year old male children who demonstrate no emotional disturbance, there is too much variability. If a WISC scoring pattern was found for severe genetic dyslexia, it would be too specific and thus not capable of generalization. The reason for this phenomena is that one must maximize true variance by the use of

populations with little error variance; otherwise the ability to detect true variance in heterogenous populations must be maximized by the simultaneous use of tests that measure the different traits of the heterogenous sample (Overall and Klett, 1972).

Section A Discussion

Using all 24 MBD scores in a discriminant analysis (cf. Section A in the Results chapter) the total number of misclassifications was found to be 18, or 15.9%. These results can be usefully compared to those of Leton (1972) who attempted to distinguish between groups of learning disabled and culturally-disadvantaged children, with discriminant analysis of the WISC subtest, and without using any type of MBD scoring. His definition of learning disabled (LD) is similar to that of MBD used in this study although he refers to both "cerebral dysfunction" and "learning problems" in the children. His term culturally disadvantaged (CD) "refers to pupils whose achievement difficulties evolve from social and cultural factors rather than neurological causes," and have poor academic achievement. He matched 127 pairs of LD-CD on the WISC Full Scale IQ. Leton (1972) found that use of the WISC subtests allowed him to misclassify only 39.4% of the LD group and 31.5% of the CD group. In comparison to the results of the present study, it is obvious that use of WISC scoring patterns gave much better results, as compared to the use of WISC subtests. Although

the two studies sampled different populations, one in a mental hygiene clinic and the other in an educational setting, there is similarity between LD and MBD, and between emotionally disturbed and culturally deprived.

Section B Discussion

Each of the 24 MBD patterns was analyzed separately in this section. The variables #2 to 9 were scores derived from a correlation of the MBD profile with each child's WISC profile. Only one pattern distinguished significantly between MBD and emotionally disturbed groups, #8, which was McGlannan's profile for specific dyslexia. However, the correlation was better for the emotionally disturbed groups than the MBD group. It can be seen from inspection of Table 7 that most of the correlations were small, yet when Table 9 is inspected it can be seen that the number of wrong versus right assignments show a nonstatistical trend to be above chance. The explanation of this phenomena can be seen by looking at Appendix D where some profiles exhibit a good fit with high correlation. However since the correlations only occur in certain syndromes, the averaging of correlations over syndromes leaves an average close to zero.

Section C Discussion

Reitan's variables #1, #2, and #24, which attempted to use Verbal vs. Performance IQ differences did not significantly distinguish between groups. This is rather surprising in view of the research support for them. However, the use of an emotionally disturbed group instead of a control group produces greater variability and thus Verbal vs. Performance IQ effects may be obscured. In inspecting Clements and Peters' patterns A, B, and C; only pattern B, which was a combination (#23) of a Performance minus Verbal IQ factor (#2) and a specific comparison of subtests (#22), was significant ($p < .05$). Unfortunately it was weighted in favor of the emotionally disturbed rather than MBD.

The patterns that were most discriminating for MBD were those of Bannatyne (#14, 15, 16, and 17) and those of the adaptation of the adaptation of Money (#10, 11, 12, and 13). Since these patterns were each subtracted from an assumed average IQ of 100, there were larger MBD scores from the clinically diagnosed MBD group since they had a lower average IQ as a group than the emotionally disturbed group. However use of these scoring methods alone would present a much larger misclassification problem (approximately 30%) than that using all 24 MBD scores (15.9%).

Section D Discussion

An optimum group of scores was selected before analysis. They significantly distinguished between groups ($p < .005$) yet the misclassification was still higher (23%) than all 24 MBD scores (15.9%).

Summary

The significance of the 24 MBD scoring variables in distinguishing between groups seems quite good even when some MBD scores by themselves seem to have little significance. The acid test for many of these MBD scores is their use in distinguishing between MBD and emotionally disturbed children especially when an obviously heterogeneous group of MBD syndromes are present. When the MBD scores are used alone, they seem of little value, yet when combined in a discriminant analysis their ability to distinguish between groups is quite high.

Chapter 6

Summary, Conclusions and Recommendations

The area of MBD has become important in education and in mental health because of mislabeling students with MBD as retarded, emotionally disturbed, unmotivated, delinquent, or unmanageable. Correct diagnosis of this condition is thus extremely important in order to proceed with medical help, educational remediation, and psychological intervention. It was the point of this paper that much emphasis is first put on psychological testing and specifically on the Wechsler Intelligence Scale for Children (WISC). Therefore, it is important that the counselor, school psychologist or clinical psychologist correctly use the diagnostic information yielded by this test. However, the research literature has generally suggested that the use of "WISC diagnosis" is not useful or valid. This directly contradicts the practical experiences of many psychometricians in the field who make diagnostic decisions on the basis of WISC patterns. The principle difference between the experiences of researchers and those of clinicians was the use of one MBD pattern versus the clinical knowledge of many WISC MBD patterns.

It was hypothesized that formalized scoring and then use of discriminant analysis of several MBD scored WISC patterns would yield better results than the use of a single WISC score pattern. In order to make this a practical study, MBD children were compared to

emotionally disturbed children, since the variability of WISC subtests of both groups is known to be great, and the clinical distinction between these groups is the most common problem in differential diagnoses.

The result confirmed the general hypothesis that discriminant analysis of 24 MBD scores could significantly distinguish ($p < .005$) between MBD and emotionally disturbed children. Two methods, those of Bannatyne (1971) and an adaptation of Money (1962), could also distinguish significantly ($p < .005$) between the groups yet they made many more wrong diagnoses. Two other methods, McGlannan (1968) and Clement and Peters (1962) could significantly distinguish between the groups ($p < .05$) yet their MBD score patterns predicted emotional disturbance instead of MBD. Other patterns with research backing were not able to distinguish between the groups.

Conclusions

1. When several WISC scoring patterns were put in mathematical form, a discriminant analysis can significantly distinguish between MBD and emotionally disturbed children.
2. Bannatyne's (1971) and an adaptation of Money's (1962) patterns can distinguish between MBD and emotionally disturbed children, although not as well as 24 MBD patterns used together.

Limitations of Research

1. The sample of children used in this study may not be similar to that seen in educational situations since the mental hygiene clinic tended to receive cases that the schools could not handle.
2. The mathematic form of some of the scoring patterns may have been other than that intended by the authors.
3. Cross-validation of the results is needed before practical use is recommended.

Recommendations

Research in the area of MBD and learning disabilities is difficult because of the many different manifestations of this disorder. One must either validate tests through the use of carefully controlled criterion groups such as Reitan has done (Reed, Reitan, and Klore, 1965) or he must use many different scoring methods in a discriminant analysis approach.

This research tends to confirm the feelings of school psychologists; that inferential diagnosis from WISC patterns is probably more reliable than researchers have maintained. However, new psychometricians may wish to make use of the classification procedures such as those in the current study.

The following specific recommendations are suggested for future research in this area:

1. Cross-validation of the present discriminant function weighting coefficients is needed in populations of MBD, learning disabled, and emotionally disturbed.

2. Scoring patterns for emotional disturbance should be added.

3. A stepwise discriminant function analysis would be helpful at eliminating patterns that contribute nothing to reducing variability.

4. A population of normal controls, and retarded children should be added to enhance the practicability of the score patterns. With more than two groups, a stepwise multiple discriminant analysis should be used.

5. MBD or other scoring patterns can be mathematically formulated in other ways such as replacement of Pearsons product-moment correlation coefficient with χ^2 curve fitting or similar methods suggested by Morf and Krane (1973).

6. MBD scoring patterns should be used to distinguish between diagnostic groups using Q type factor analysis (Overall and Klett, 1972) and diagnostic types might be isolated using statistically produced typologies (Overall, Henry and Markett, 1972) and then refined using a multitrait-multimethod matrix (Campbell and Fiske, 1959).

The philosophy behind this study is that MBD is not a simple syndrome and clinical patterns together with multivariate statistics are both necessary for adequate research.

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Appendices

Appendix A - Data Identification

Columns

1 - 4	Clinic Identification Number
5	0 - Females, 1 - Males
6 - 7	Age in years
8 - 10	Full Scale IQ
11 - 13	Verbal IQ
14 - 16	Performance IQ
17 - 18	Scaled Score for Information
19 - 20	Scaled Score for Comprehension
21 - 22	Scaled Score for Arithmetic
23 - 23	Scaled Score for Similarities
25 - 26	Scaled Score for Vocabulary
27 - 28	Scaled Score for Digit Span
29 - 20	Scaled Score for Picture Completion
31 - 32	Scaled Score for Picture Arrangement
33 - 34	Scaled Score for Block Design
35 - 36	Scaled Score for Object Assembly
37 - 38	Scaled Score for Coding
39 - 40	Bender Gestalt Raw Scores (Koppitz scoring system) (Koppitz, 1963)
41 - 42	Bender Gestalt Emotionality Scores (Koppitz scoring systems) (Koppitz, 1963)
43 - 44	DAP Development Scores (Koppitz scoring system) (Koppitz, 1968)
45 - 46	DAP Emotionality Scores (Koppitz scoring system) (Koppitz, 1968)

Columns

- 47 - 48 EEG Pattern (see EEG scoring classification)
- 49 - 50 EEG Pattern (see EEG scoring classification)
- 51 EEG - 1 if abnormal, 0 if normal
- 52 Neurological Examination - 1 if abnormal, 0 if normal.
- 53 - 57 DSM II Diagnostic number if emotional problem
- 58 - 62 DES II Diagnostic number of MBD
- 63 1 if classified into OBD group with sufficient WISC data, 2 if classified into the emotional group with sufficient WISC data.

Appendix A (continued) EEG Scoring Classifications

00	00	Normal
	1	Diffuse Slow Waves
	2	Parieto-Occipital Slow Waves
	3	Temporal Slow Waves
	4	Other Slow Waves
	5	Focal Slow Waves
	6	Diffuse Sharp Waves
	7	Focal Sharp Waves
	8	Under 3 per sec Sharp Waves
	9	3 per sec Sharp Waves
	10	6 per sec Sharp Waves
	11	Positive Spikes
	12	Discharges focal & diffuse (bursts)
	13	Diffuse Depression
	14	Focal Depression
	15	Excessive Fast Wave
	16	Background rhythm
	17	Hyperventilation
	18	Photic Driving
	19	Immature Record - Poorly organized
	20	Combinations

3441012049		312	
349411207109606210071508070606030509090803150419061			309.91
3567109	121		309.4
3679013	0200160219121		309.9
3727113114113113131010161116191111090902011801		307.2	2
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383610907606709305050504060409071008091200150219031	310		309.91
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3936112			307.2306.1
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4345109	011		307.1309.7
4573113			301.7
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4591108			
4595014			295.5
4599004			
4600111107106109			
4601110			92.7
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4605			
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4607013			295.3
4609112			
4610108			307.1
4611108			307.1
4614004			50.4X
4615114			307.2
4618111			306.1
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4633107			307.1

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5168014069074069070505080408090601040802001702 000		300.4309.9
517000707307507407100404050806060508080700 11061		308.4308.0
517011508207908907050608071407090809090209240201191		310 309.91
517310908508608606060909090810080709090901140206011		309.91
5185114091101096101806080706140611120803003001		300.4 2
5187109		90.4
5189015		307.1
5199106112103120091112101208131412111412010802		308.4306.11
5200014		308.4
5206004		90.4
520900710510310708121011111009111110140501 01191		308.4306.32
5217107120113125121609131012171315091405001900		300.3308.32
5218115		300.4
5219106100099 131009090909 08001800		308.2308.2
5220109085085087091005050906120709060708011102		308.4308.21
5221013		307.2
5223110078087075		306.3
5226112100097103090809120812091211110901032303		300.4 2
5231115		310
5233115		318
523510710909912009101007101312141019130701200312031		308.4308.01
5237112		318
5238014		300.0
5241110131129128131517141612151413131402002203 000		307.1 2
5242005083	17	060 307.1

524401010710910408121014121209091010150100230019011		308.01
5245005		90.4X
5246006		307.1
5247110		300.0
5248109108114100	06121	307.1308.0
5250113112120100131710141312091011101105002201		300.3306.32
525111111612410413181416121010110710150600	01191	301.3308.01
5252012086079097080707050605130408131004032200	000	306.11
5255013088081097070607090605111007081205012200		295.8309.91
525710610510310711091313080808111414080900	031	306.11
5263006088	04001000	307.1
5266014		300.4
5269015108095121101007100908141213141202002700		294.3306.11
5270006		90.4X
5272015108112100	02002200	300.4
5276114083077092	11011	310 309.9
528004103		318
5298112	0300270006011	308.0
5310110094097092090810120908140809040910002100		309.41
5311011093077113050511050610081012151402001900		295.8309.91
5313005114110115121113091411131114111213001000	061	308.01
5321108069081061	11061	311 309.9
532511009909610311110709090910111409080300	000	295.8309.91
532800908108707807100609080808090604071200130006011		309.91
533011309709210310080810081009101114080100190319051		307.1306.11
5331115101090110111908131107101205061000001900	191	309.91
5334106109096121071110091108151115141010000901		306.11
5335107093029099060810090808090708091609000901		309.91
5339112		307.1
5342009107090124091004091012141412151201002300	191	306.11
534500809308410609090805060913110713100700190001061		306.11
5346107106109101091011161408141112140801001900		300.3 2
5348105	061	307.1308.0
535111107106608204050604040309100806040600	060	310 309.4
535510706707007106040604060408040306081301110019061		309.4
5357012	0100	300.4
536110707507707606060804080511050906061400		310 309.9
5362012	0100	300.4
5363012	01002201	300.4
5365002100		318
5370045078066096050403080404110908100901002201		309.91

5371006059065061050303050607040606040215000701010611311 309.9

Appendix B

The data in this appendix is identified in the same order as that in Appendix A for Rows 2 through 78 and Rows 87 through 124. Rows 1, 79 through 86, and 125 through 131 contain information for computer processing such that together with the Fortran program in Appendix C, the data in Appendix B may be processed directly to yield the scored data for MBD listed in Appendix D. Rows 2 through 78 contain the data for the MBD children and Rows 87 through 125 contain the data for the emotionally disturbed children

0761
 471810909009208709110708081010120/0904020016 307.2306.11
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 5342009107090124091004091012141412151201002300 191 306.11
 383610907606709305050504060409071008091200150219031 310 309.91
 3972109107105107111208121106110914111002002103 307.1308.01
 477510909310408211120915110610100/06040801 06011 306.11
 498710911711411711151012131016121312090500 12111 309.41
 517310908508608606060909090810050709090901140206011 309.91
 5220109085085087091005050906120709060708011102 308.4308.21
 3921008077087069080708080909060206090916020903061911 309.91
 484100810411009713110912141108110810110600 307.1308.01
 534500809308410609090805060913110713100700190001061 306.11
 4260108086080096080508060707100910081010011501 011 308.4309.91
 469710808307109907030505070710120907110602 307.1310 1
 47191080970960990811061108130814070910090012 307.2306.11
 488110811612110715131409161314111113080600140514711 308.2308.01
 491810808207709006090505070908071010080800130119061 310 308.01
 471100710712009213111010101508090910080901 307.1306.11
 484800709008409908070909040709110812090800 01191 307.1306.11
 462410709610009212100910090910120708101201XXXX16061X308.1308.01
 472310708007209206021106040509060811101100 306.11
 472710707408606506100807100604050405070901160101 1X 308.01
 472810711011510308141218101212130910080601 01 1 307.1308.01
 474510709405709207120813100809090911061801 01061 307.1308.01
 484610708107908706100406070509071211021302 306.11
 494810709109409006091014070814080609060800130101061 307.1309.91
 496810708707909906060807080414080706140800120301031 295.8309.91
 498910707608507107050411110406090605030901 120611310 309.91
 523510710909912009101007101312141015130701200312031 308.4308.01
 8335107093089099060810090808090708091609000901 309.91
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 486500609309709007100711130909090607121500 0 300.3309.21
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 4891106120121114121016181113141513120611001602 308.2309.91
 4895106102106097091112131011091014080713011302 191 307.1309.91
 4907106091092090080814080609070911070918021901 308.3306.31
 4993106113104113130512131110131814110911021002 300.3306.11

5199106112103120091112101208131412111412010802 308.4306.11
525710610510310711091313080808111414080900 031 306.11
5334106109096121071110091108151115141010000901 306.11
488700511210811411080915101408121311161001 011 309.91
5313005114110115121113091411131114111213001000 061 308.01
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379511008809408508044311090609060310091000180101061 309.91
458411009511007911121016140608090608061301 061 309.91
4898110088104074111010121006090705020804021206 307.1306.61
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522511009909610311110709090910111409080300 000 295.8309.91
5311011093077113080511050610081012131402001900 295.8309.91
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479311110410810710460614120512120914090202 307.2309.91
4962111084090080101005110707130607070303001202 310 309.91
496911108709408213050810090506090807070609170202191 308.1306.61
4997111084080092080506090607100908081202011702 307.1306.11
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5252012086079097080707050605130408131004032200 000 306.11
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483711209109109309070709081209100808120300 295.5309.91
4920112087086090070509100808060813100605001403 308.4 1
4953112069060085030504030104090809080509001701 0 307.1306.11
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5255013088081097070607090605111007081205012200 295.8309.91
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46791141101180991313131209130609111209020022 306.11
5138015093090097060608110910111109090800002003 307.2306.61
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517011508207908907050608071407090809090200240201191 310 309.91
5331115101090110111908131107101205061000001900 191 309.91
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1110100812111108081110

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 0000000600080000110008
 0370
 5241110131129128131517141612151413131402002203 000 307.1 2
 462711110110609610111213081212091008080010XXXX 300.2 2
 4845111107113099141010151110140810080901002100 307.1 2
 4945111093089099100607110807081008071605001203 295.8306.12
 5142012125128117131715141314160811161103092200010610301.3309.92
 46801121281401101620162015121315121306040016 307.2 2
 475811209009109006100910090708090911060100 307.2 2
 4791112108104111121212130708131212101000022003 307.1 2
 489411209108709606100610080808091410060400 301.4 2
 5226112100097103090809120812091211110901032303 300.4 2
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 520900710510310708121011111009111110140501 01191 308.4306.32
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 5118108107101111120812111107141210091306012100 307.1306.12
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 5998109096099094130408141006061209110802011803 00120307.1 2
 5135109101108095110509140808121111111106022103 308.2 2

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0912091411090911141108
1110100812111108081110
0710061110060607080608
0000001500080000110006
0000000600080000110008

Appendix C

This appendix contains the Fortran scoring program for MBD.

It is written in Fortran IV and is compatible for a Xerox Sigma 7 computer.

```

C   DWIGHT LEONARD PROJECT # 190 MSU EDCO
C   SCORING PROGRAM FOR WISC SUBTEST SCORES
C   THIS PROGRAM IS DESIGNED TO GENERATE 24 DIFFERENT
C   RESULTS THAT ARE DERIVED FROM EIGHT THEORISTS WHO FEEL THEIR SCORING
C   METHODS FOR THE WISC PREDICT MINIMAL BRAIN DYSFUNCTION OR LEARNING
C   DISABILITY. THIS PROGRAM WILL EVALUATE N NUMBER OF SUBJECTS ON WHOM
C   14 WISC TEST SCORES ARE GIVEN IN ROWS IN THIS ORDER,
C   PSIG, VIG, PIG, I, C, A, S, V, DS, PC, PA, BD, OA, AND CD.
C   THE FORMAT FOR SUBTESTS WILL BE FORMAT (7X,3F3.0,11F2.0)
C   DATA IS IN A, SCORE PATTERNS IN B, AND RESULTS IN C.
C   IF M IS 1, REPEAT PROGRAM. IF M IS 0, END.
      DIMENSION A(85,14)
      DIMENSION B(7,14)
      DIMENSION C(85,24)
      CALL TRUNCATE
100  READ (105,101) N,M
      READ (105,102) ((A(I,J),J=1,14),I=1,N)
      READ (105,103) ((B(K,L),L=1,11),K=1,7)
      DO 30 I=1,N
        C(I,1)=A(I,2)+100.0=A(I,3)
        C(I,2)=A(I,3)+100.0=A(I,2)
C   CORRELATION COEFFICIENT
      DO 50 L=3,9
        SY=0.0
        SX=0.0
        SXY=0.0
        SX2=0.0
        SY2=0.0
        LN=L-2
        IF (L=7) 250,250,350
250  DO 10 K=1,11
10   CALL CORREL
        XN=11.0
        GO TO 35
350  REPEAT 20, FOR K=4,6,9,11
20   CALL CORREL
        XN=4.0
36   AX=(XN*SXY)/(SX*SY)
        BX=(XN*SX2-(SX**2))/(XN*SY2-(SY**2))
        BX=SQRT (BX)
        C(I,L)=AX/BX+1.0

```

```

50  CONTINUE
    C(I,10)= 100.0*((A(I,12)+A(I,13))/2.0)
    C(I,11)= 100.0*((A(I,4)+A(I,5))/2.0)
    C(I,12)= 100.0*((A(I,6)+A(I,9))/2.0)
    C(I,13)=C(I,10)+C(I,11)+C(I,12)
    C(I,14)= 100.0*((A(I,10)+A(I,12)+A(I,13))/3.0)
    C(I,15)= 100.0*((A(I,5)+A(I,7)+A(I,8))/3.0)
    C(I,16)= 100.0*((A(I,14)+A(I,9)+A(I,11))/3.0)
    C(I,17)=C(I,14)+C(I,15)+C(I,16)
    X=0.0
    XSQ=0.0
    DO 40 J=4,14
        X=A(I,J)+X
        XSQ=A(I,J)**2+XSQ
40  CONTINUE
    C(I,18)=XSQ*(X**2/11.0)
    C(I,19)=(A(I,4)+A(I,5)+A(I,7)+A(I,10)+A(I,11)+100.0)*(A(I,6)+
3A(I,12)+A(I,13)+A(I,9)+A(I,14))
    C(I,20)=(A(I,5)-A(I,6))*(A(I,10)-A(I,12))+(20.0)
    C(I,21)= C(I,18)+C(I,19)+C(I,20)
    C(I,22)=(A(I,4)+A(I,5)+A(I,6)+A(I,7)+A(I,8)+A(I,9)+100.0)*
4(A(I,12)+A(I,13)+A(I,14))
    C(I,23)= C(I,22)+C(I,2)
    C(I,24)=(A(I,2)-A(I,3))**2
30  CONTINUE
    WRITE (108,152) ((I+100,C(I,L),L=1,24),I,I=1,N)
    IF (M) 200,200,100
152  FORMAT (X12,'1',12F6.1/4X12F6.1,I2,I2,'2')
101  FORMAT (I3,I1)
102  FORMAT (7X,3F3.0,11F2.0)
103  FORMAT (11F2.0)
200  STOP
    LOCAL SUBROUTINE CORREL
    SX=BX+A(I,K+3)
    SY=BY+B(LN,K)
    SXY=(A(I,K+3)*B(LN,K))+SXY
    SX2=(A(I,K+3)**2)+SX2
    SY2=(B(LN,K)**2)+SY2
    RETURN
    END

```

Appendix D

The MBD scored data are contained in this appendix. For each subject, there are 24 scores listed across in 12 columns for 2 rows. The first three numbers in each row are subject identification numbers and the MBD subject's scores are contained in rows 011 through 762. After 762 the emotionally disturbed scored data is in rows 011 through 372.

011	105.0	95.0	1.4	.7	1.1	1.0	.9	1.4	.9	92.0	90.0	91.5
12	273.5	91.3	91.0	91.3	273.7	48.5	113.0	27.0	188.5	133.0	228.0	25.0
021	123.0	77.0	1.3	.7	1.2	.9	1.8	1.3	.3	94.0	88.0	92.0
22	274.0	93.3	86.3	91.7	271.3	122.5	112.0	25.0	259.5	142.0	219.0	529.0
031	109.0	91.0	1.4	.6	1.2	.8	1.6	1.5	.1	95.0	91.5	93.0
32	279.5	94.0	91.0	92.0	277.0	28.7	112.0	26.0	166.7	131.0	222.0	81.0
041	66.0	134.0	.8	1.2	1.0	1.0	.8	.1	1.7	86.5	90.5	92.0
42	269.0	86.3	90.3	87.3	264.0	96.0	101.0	28.0	225.0	116.0	249.0	1156.0
051	74.0	126.0	.7	1.5	1.0	.9	.7	.6	1.8	91.0	95.0	95.5
52	281.5	91.0	95.0	93.3	279.3	46.7	94.0	19.0	159.7	102.0	228.0	676.0
061	98.0	102.0	1.2	1.1	1.7	.7	1.5	1.5	1.4	87.5	88.5	93.0
62	269.0	88.0	88.3	91.7	268.0	46.7	106.0	21.0	173.7	125.0	227.0	4.0
071	122.0	78.0	1.6	.7	1.5	.8	1.6	2.0	.4	93.5	88.5	92.5
72	274.5	92.3	87.3	93.3	273.0	101.6	126.0	26.0	253.6	147.0	225.0	484.0
081	97.0	103.0	1.4	.8	1.4	1.0	1.2	1.8	1.4	87.5	87.0	90.0
82	264.5	86.3	86.7	89.7	262.7	44.9	112.0	28.0	184.9	137.0	240.0	9.0
091	100.0	100.0	.6	1.3	.8	1.4	.9	1.0	.1	92.0	94.0	91.5
92	277.5	91.3	92.0	92.7	276.0	26.9	94.0	20.0	140.9	122.0	222.0	.0
101	98.0	102.0	1.5	.7	1.0	1.3	1.1	.7	2.0	92.5	90.5	94.5
102	277.5	91.0	92.0	93.3	276.3	50.2	110.0	28.0	188.2	122.0	224.0	4.0
111	118.0	82.0	1.0	.6	.7	1.5	1.3	.8	.3	94.5	92.5	91.5
112	278.5	94.3	92.0	93.3	279.7	46.0	94.0	19.0	199.0	129.0	211.0	324.0
121	113.0	87.0	1.6	.4	1.0	1.3	1.5	1.1	.0	91.0	88.0	90.0
122	269.0	91.3	87.7	89.0	268.0	36.2	106.0	22.0	164.2	141.0	225.0	169.0
131	78.0	122.0	.9	1.3	.5	1.3	.3	.0	1.2	90.0	91.0	91.5
132	272.5	89.0	93.3	90.0	272.3	66.9	100.0	27.0	193.9	116.0	238.0	484.0
141	84.0	116.0	.6	1.6	.7	.9	.5	.4	1.8	91.0	93.5	92.5
142	277.0	90.7	94.0	91.3	276.0	28.0	95.0	17.0	140.0	113.0	229.0	256.0
151	72.0	128.0	.7	1.5	.7	.8	.6	.2	1.6	92.0	95.0	94.0
152	281.0	91.3	95.0	90.0	276.3	74.7	98.0	19.0	191.7	107.0	235.0	784.0
161	97.0	103.0	1.0	.9	1.1	.7	1.1	.9	.3	92.0	90.5	90.5
162	273.0	92.0	90.0	87.7	269.7	62.7	107.0	26.0	198.7	131.0	234.0	9.0
171	114.0	86.0	1.6	.4	.7	1.7	.7	.9	1.3	88.0	86.0	86.5
172	260.5	87.3	87.3	89.3	264.0	60.7	103.0	22.0	185.7	148.0	234.0	196.0
181	87.0	113.0	.8	.9	1.1	1.1	.8	.4	1.9	90.0	92.5	93.0
182	275.5	90.7	93.0	92.0	275.7	32.5	93.0	22.0	147.5	113.0	226.0	169.0
191	128.0	72.0	1.1	.4	.8	1.3	.9	.9	.8	90.5	88.0	87.5
192	266.0	91.0	85.7	89.3	270.0	44.2	99.0	20.0	163.2	142.0	214.0	784.0
201	85.0	115.0	.5	1.8	1.0	.6	.5	1.3	.6	90.0	92.5	92.0
202	274.5	90.3	93.3	91.0	274.7	44.7	99.0	19.0	162.7	115.0	230.0	225.0

211	108.0	92.0	1.4	.8	.7	.9	1.2	.9	.1	94.0	89.0	91.0
212	274.0	92.7	90.3	89.7	272.7	40.5	114.0	24.0	178.5	137.0	229.0	64.0
221	80.0	120.0	.4	1.8	.7	1.0	.4	.6	1.3	90.5	96.0	92.0
222	278.5	90.7	96.0	93.0	279.7	86.9	84.0	12.0	182.9	105.0	225.0	400.0
231	121.0	79.0	1.5	.4	1.0	1.3	1.6	.9	.1	95.5	92.0	93.0
232	280.5	95.7	91.0	94.0	280.7	44.7	102.0	22.0	168.7	131.0	210.0	441.0
241	112.0	88.0	1.0	1.1	1.5	.6	1.4	1.8	.3	90.5	89.0	88.0
242	267.5	89.7	86.0	89.0	264.7	86.7	114.0	25.0	225.7	147.0	235.0	144.0
251	105.0	95.0	1.2	.9	1.8	.8	1.6	2.0	.6	90.0	90.5	92.0
252	272.5	90.3	88.3	92.3	271.0	44.2	108.0	24.0	176.2	132.0	227.0	25.0
261	92.0	108.0	1.1	1.0	1.6	.9	1.0	1.5	1.7	88.5	92.0	98.5
262	276.0	89.3	92.3	95.3	277.0	93.6	104.0	23.0	220.4	113.0	221.0	64.0
271	104.0	96.0	.9	1.3	1.2	.9	1.1	1.8	.2	92.5	92.5	91.0
272	276.0	90.3	90.0	92.7	273.0	83.6	112.0	27.0	222.6	133.0	229.0	16.0
281	80.0	120.0	.8	1.5	.6	1.0	.9	.6	1.0	93.5	94.0	94.0
282	281.5	91.0	93.0	91.3	275.3	102.0	102.0	25.0	229.0	112.0	232.0	400.0
291	114.0	86.0	1.5	.9	1.5	.8	1.6	2.0	.5	94.5	94.0	96.0
292	284.5	94.3	91.0	94.7	280.0	76.7	116.0	21.0	213.7	128.0	214.0	196.0
301	79.0	121.0	.7	1.2	.6	1.2	.4	.0	1.3	87.8	90.5	88.5
302	266.5	87.7	91.0	86.7	265.3	57.6	91.0	22.0	170.6	121.0	242.0	441.0
311	90.0	110.0	.5	1.4	.6	1.0	1.0	.4	.8	91.5	93.0	91.0
312	275.5	91.3	91.7	89.7	272.7	66.9	88.0	19.0	173.9	116.0	226.0	100.0
321	101.0	99.0	1.0	1.3	1.8	.3	1.3	2.0	.0	92.5	92.0	91.0
322	275.5	91.3	89.7	90.7	271.7	98.2	116.0	19.0	233.2	135.0	234.0	1.0
331	85.0	115.0	.9	1.1	1.1	1.0	1.0	.8	1.9	90.5	91.5	95.0
332	277.0	89.7	92.7	93.0	275.3	62.2	103.0	27.0	192.2	111.0	226.0	228.0
341	107.0	93.0	1.3	.7	.9	1.2	1.6	.8	.2	93.5	91.5	92.0
342	277.0	92.7	88.7	90.0	271.3	50.9	108.0	26.0	181.9	132.0	228.0	49.0
351	105.0	98.0	1.2	.8	1.3	.8	1.1	1.2	1.8	89.5	88.5	91.0
352	289.0	90.7	90.3	92.0	273.0	36.2	100.0	18.0	154.2	128.0	223.0	25.0
361	107.0	93.0	.9	1.3	1.4	.6	1.0	1.9	.7	87.5	89.0	89.5
362	262.0	87.0	87.0	88.7	262.7	102.2	109.0	15.0	226.2	149.0	242.0	49.0
371	109.0	91.0	.8	1.0	1.7	.4	1.3	1.8	1.2	89.0	90.0	88.5
372	267.5	89.7	88.7	90.7	269.0	44.5	100.0	14.0	158.5	137.0	228.0	81.0
381	102.0	98.0	.5	1.4	.5	.6	.7	.8	2.0	91.0	92.0	88.5
382	271.5	91.7	92.7	91.0	275.3	48.2	90.0	10.0	148.2	126.0	224.0	4.0
391	91.0	109.0	.9	1.5	1.1	.5	.7	1.8	1.3	87.5	91.0	89.0
392	267.5	87.3	90.3	87.7	265.3	106.2	106.0	12.0	224.2	130.0	239.0	81.0
401	83.0	117.0	1.0	1.5	.9	.7	1.0	.7	1.3	88.5	90.0	90.0
402	268.5	88.0	89.0	88.0	265.0	36.7	100.0	20.0	156.7	125.0	242.0	289.0
411	96.0	104.0	.7	1.5	1.5	.5	.9	1.8	1.3	86.0	90.0	89.5

412	265.5	88.0	90.0	91.0	269.0	64.5	95.0	10.0	169.5	126.0	230.0	16.0
421	75.0	125.0	.8	1.4	1.3	.9	.8	1.1	1.9	85.5	91.0	91.0
422	267.5	85.3	89.7	90.3	265.3	72.0	96.0	21.0	189.0	117.0	242.0	625.0
431	94.0	106.0	.4	1.3	1.1	.6	1.2	.7	.3	88.0	90.5	83.5
432	267.0	89.3	89.0	86.0	264.3	74.7	91.0	14.0	179.7	127.0	233.0	36.0
441	95.0	105.0	1.2	.9	.8	1.3	.8	.6	2.0	87.5	88.5	88.0
442	264.0	87.3	88.7	88.7	264.7	22.9	95.0	17.0	134.9	133.0	238.0	25.0
451	74.0	126.0	.4	1.6	1.1	.7	.4	.8	1.9	87.5	96.5	90.0
452	274.0	89.0	96.3	91.0	276.3	138.2	79.0	7.0	224.2	104.0	230.0	676.0
461	62.0	138.0	.5	1.5	1.0	.8	.6	.5	1.9	87.0	93.0	92.0
462	272.0	87.3	93.7	90.0	271.0	120.0	88.0	20.0	228.0	102.0	240.0	1444.0
471	89.0	111.0	1.2	.8	1.0	1.5	1.0	.4	1.9	89.0	91.0	94.5
472	274.5	89.0	91.3	93.0	273.3	76.5	97.0	27.0	200.5	114.0	225.0	121.0
481	121.0	79.0	1.3	.8	1.0	.9	1.6	1.3	.0	93.8	87.5	90.0
482	271.0	92.3	86.7	89.3	268.3	82.7	116.0	29.0	227.7	145.0	224.0	441.0
491	105.0	95.0	.7	.9	1.1	.9	1.6	.8	.2	90.0	90.0	89.0
492	269.0	90.3	87.3	88.0	265.7	48.0	95.0	21.0	164.0	133.0	228.0	25.0
501	109.0	91.0	.8	1.4	.7	1.2	.9	1.4	.1	92.5	94.0	90.5
502	277.0	92.0	92.0	93.0	277.0	73.6	95.0	15.0	183.6	127.0	218.0	81.0
511	131.0	69.0	1.6	.6	1.4	.9	1.7	1.9	.3	94.0	88.5	92.0
512	274.5	93.3	86.0	93.0	272.3	122.7	122.0	24.0	268.7	151.0	220.0	961.0
521	130.0	70.0	1.5	.7	1.0	1.0	1.5	1.6	.1	96.8	89.8	92.0
522	278.0	94.7	89.3	93.0	277.0	87.6	119.0	24.0	229.6	144.0	214.0	900.0
531	105.0	95.0	1.0	1.2	1.0	.9	1.2	1.8	.4	93.5	91.8	91.0
532	276.0	91.0	90.3	91.7	273.0	62.9	111.0	23.0	196.9	134.0	229.0	25.0
541	93.0	107.0	1.2	.9	1.5	.6	1.1	1.3	1.8	88.5	89.0	92.0
542	269.5	89.0	90.3	90.7	270.0	35.6	105.0	20.0	160.6	125.0	232.0	49.0
551	64.0	136.0	.3	1.6	.8	.9	.4	.1	1.7	86.5	95.0	89.5
552	271.0	88.3	94.7	88.7	271.7	133.6	71.0	10.0	214.6	101.0	237.0	1296.0
561	82.0	118.0	.4	1.7	1.3	.5	.9	1.8	.7	90.8	94.0	94.0
562	278.5	90.3	93.3	91.7	275.3	68.9	103.0	19.0	190.9	112.0	230.0	324.0
571	101.0	99.0	1.5	.9	1.5	.9	1.5	1.8	.6	88.5	87.0	94.5
572	270.0	88.3	86.0	91.3	265.7	115.6	121.0	33.0	269.6	131.0	230.0	1.0
581	110.0	90.0	1.3	.8	1.3	1.1	1.2	1.9	.6	93.0	90.0	94.0
582	277.0	91.0	90.7	94.7	276.3	83.6	121.0	31.0	235.6	133.0	223.0	100.0
591	112.0	88.0	1.3	1.0	1.1	.8	1.2	1.8	.7	92.8	91.0	93.5
592	277.0	93.0	92.0	93.0	278.0	54.9	108.0	15.0	177.9	128.0	216.0	144.0
601	88.0	112.0	.7	1.5	.6	1.0	.8	.7	.4	93.8	93.5	93.5
602	280.5	92.3	93.3	90.7	276.3	48.2	103.0	24.0	178.2	116.0	228.0	144.0
611	120.0	80.0	1.3	.7	1.0	1.0	1.6	1.1	.1	91.5	84.5	88.0
612	264.0	91.0	84.7	88.0	263.7	102.5	112.0	27.0	241.5	151.0	231.0	400.0

621	22.0	118.0	.8	1.3	.7	1.4	.6	.4	1.5	89.5	92.5	94.0
622	276.0	88.7	94.0	93.7	276.3	93.6	94.0	25.0	212.6	107.0	225.0	324.0
631	134.0	66.0	1.1	.9	.7	1.1	1.1	.9	.3	97.5	91.5	89.5
632	278.5	96.3	92.7	94.0	283.0	148.9	99.0	13.0	260.9	139.0	205.0	1156.0
641	98.0	102.0	.7	1.0	.6	.9	1.0	.2	.7	93.5	92.0	90.5
642	276.0	92.7	92.0	88.3	273.0	51.6	99.0	21.0	171.6	126.0	228.0	4.0
651	96.0	104.0	.5	1.4	1.6	.5	1.0	1.7	1.5	88.5	94.0	91.5
652	274.0	90.3	92.3	92.7	275.3	51.6	90.0	9.0	150.6	118.0	222.0	16.0
661	75.0	125.0	.6	1.6	1.1	.6	.5	.9	2.0	91.5	96.0	96.0
662	283.5	91.3	97.0	94.3	282.7	74.5	98.0	21.0	193.5	98.0	223.0	625.0
671	120.0	80.0	1.2	.6	1.2	1.0	1.5	1.6	.2	92.0	90.0	88.5
672	270.5	92.0	88.3	91.0	271.3	36.5	101.0	20.0	157.5	142.0	222.0	400.0
681	84.0	116.0	.7	1.7	.8	.7	.9	.8	.7	92.5	93.5	94.0
682	280.0	91.3	93.0	91.0	275.3	50.0	104.0	23.0	177.0	113.0	229.0	256.0
691	106.0	94.0	1.5	.6	1.3	.7	1.6	1.7	1.1	91.0	86.5	91.0
692	268.5	90.3	87.7	89.3	267.3	49.6	114.0	25.0	188.6	139.0	233.0	36.0
701	89.0	111.0	.7	1.3	1.3	.9	.7	1.6	1.4	87.5	91.0	91.0
702	269.5	88.7	91.3	90.7	270.7	32.5	96.0	18.0	146.5	121.0	232.0	121.0
711	119.0	81.0	1.0	.7	1.2	.9	1.1	1.4	.8	88.5	87.0	87.0
712	262.5	90.3	88.7	89.7	268.7	54.9	95.0	15.0	164.9	141.0	222.0	361.0
721	93.0	107.0	.6	1.5	1.2	.7	.9	1.8	.4	91.0	94.0	91.0
722	276.0	90.3	91.3	90.3	272.0	32.9	101.0	20.0	153.9	124.0	231.0	49.0
731	74.0	126.0	.8	1.5	1.2	.8	.8	1.0	1.6	86.5	90.0	92.5
732	269.0	86.3	90.3	89.3	266.0	55.6	102.0	24.0	181.6	115.0	241.0	676.0
741	70.0	130.0	.6	1.7	1.1	.7	.8	1.2	1.1	91.0	95.5	96.5
742	283.0	90.3	94.7	92.7	277.7	81.6	103.0	24.0	208.6	101.0	231.0	900.0
751	90.0	110.0	.5	1.1	.8	1.0	.6	.5	.9	91.5	94.0	90.0
752	275.5	92.0	93.3	89.3	274.7	54.9	90.0	18.0	162.9	121.0	231.0	100.0
761	80.0	120.0	1.6	.5	1.1	.9	1.6	1.4	.1	94.5	85.0	92.5
762	272.0	93.0	85.7	90.3	269.0	149.6	129.0	36.0	314.6	148.0	268.0	400.0
011	101.0	99.0	1.4	1.0	.9	1.1	1.2	1.3	.6	87.0	86.0	85.5
12	258.5	86.3	85.0	86.7	258.0	21.6	102.0	20.0	143.6	147.0	246.0	1.0
021	110.0	90.0	.8	1.1	1.1	.8	1.0	1.7	.5	91.0	89.5	88.0
22	268.5	90.0	89.3	90.3	269.7	34.2	105.0	21.0	160.2	140.0	230.0	100.0
031	114.0	86.0	1.2	.9	1.1	1.1	1.3	1.9	.3	91.0	88.0	90.0
32	269.0	89.3	88.0	91.0	268.3	59.6	114.0	24.0	157.6	143.0	229.0	196.0
041	90.0	110.0	.8	1.4	.8	.7	1.2	.7	.7	92.5	92.0	93.0
42	277.5	92.3	91.7	89.0	273.0	78.9	100.0	19.0	197.9	118.0	228.0	100.0
051	111.0	89.0	1.1	.7	.9	1.5	1.0	1.4	.3	86.5	85.0	85.5
52	257.0	85.7	85.3	89.0	260.0	70.7	101.0	27.0	198.7	148.0	237.0	121.0
061	130.0	70.0	1.5	.7	1.5	.8	1.5	1.9	.5	87.5	82.0	86.0

62	255.5	87.3	81.7	89.0	258.0	154.5	125.0	25.0	304.5	168.0	238.0	900.0
071	101.0	99.0	1.1	1.2	1.7	.7	1.3	2.0	.9	90.0	92.0	92.0
72	274.0	90.7	90.3	92.7	273.7	26.7	101.0	20.0	147.7	125.0	224.0	1.0
081	93.0	107.0	.9	1.5	1.3	.4	1.0	1.8	.9	89.0	88.0	90.0
82	267.0	88.3	89.3	90.0	267.7	40.0	110.0	21.0	171.0	132.0	239.0	49.0
091	91.0	109.0	.8	1.2	1.9	.5	1.3	1.6	1.6	88.0	92.0	93.0
92	273.0	89.3	90.7	92.3	272.3	56.5	99.0	18.0	173.5	118.0	227.0	81.0
101	94.0	106.0	.4	1.4	1.4	.4	.8	1.7	.8	89.0	91.5	89.8
102	270.0	89.7	90.7	89.0	269.3	26.0	98.0	17.0	141.0	127.0	233.0	36.0
111	114.0	86.0	1.5	.6	1.4	.9	1.7	1.8	.5	90.0	83.5	92.0
112	265.5	89.3	84.7	91.0	265.0	122.7	124.0	33.0	279.7	145.0	231.0	196.0
121	86.0	114.0	.5	1.5	.7	1.1	.4	.8	1.9	87.5	93.5	87.0
122	268.0	88.0	92.3	89.0	269.3	82.7	81.0	7.0	170.7	123.0	237.0	196.0
131	84.0	116.0	.4	1.8	1.4	.4	1.2	1.3	1.1	88.0	92.0	92.0
132	272.0	88.3	90.3	90.3	269.0	58.9	96.0	18.0	172.9	115.0	231.0	256.0
141	78.0	125.0	.3	1.9	.9	.6	.7	.7	1.3	88.5	93.0	91.5
142	273.0	88.7	92.7	89.3	270.7	60.7	91.0	16.0	167.7	110.0	235.0	625.0
151	120.0	80.0	1.5	.3	1.4	1.0	1.8	1.8	.2	89.5	85.0	89.0
152	263.5	90.0	85.3	89.0	264.3	53.6	109.0	25.0	187.6	147.0	227.0	400.0
161	100.0	100.0	.9	1.0	1.0	1.1	.9	1.6	.5	90.0	88.5	87.0
162	265.5	87.0	87.7	88.0	262.7	110.2	114.0	28.0	252.2	147.0	247.0	.0
171	89.0	111.0	.6	1.5	1.3	.8	1.0	1.5	.4	86.5	90.0	91.0
172	267.5	87.3	89.0	90.0	266.3	70.9	98.0	22.0	190.9	121.0	232.0	121.0
181	118.0	82.0	1.3	.5	1.1	1.1	1.6	1.3	.0	90.5	85.5	90.0
182	266.0	90.3	85.7	88.3	264.3	82.2	112.0	28.0	222.2	146.0	225.0	324.0
191	115.0	88.0	1.3	.5	.7	1.4	1.3	.8	.2	95.5	91.5	90.5
192	277.8	94.0	89.7	90.0	273.7	66.7	108.0	28.0	202.7	140.0	225.0	225.0
201	100.0	100.0	.6	1.3	1.3	.7	1.4	1.6	.1	88.5	90.5	88.5
202	267.5	89.0	87.7	88.0	264.7	34.7	97.0	17.0	148.7	134.0	234.0	.0
211	105.0	95.0	1.2	.9	1.2	1.1	1.1	1.3	1.7	88.5	87.0	94.5
212	270.0	87.7	89.7	93.3	270.7	126.5	112.0	34.0	272.5	121.0	216.0	25.0
221	112.0	88.0	1.6	.5	1.1	1.3	1.4	1.6	.8	87.5	83.5	88.0
222	259.0	87.0	84.3	89.7	261.0	69.6	108.0	27.0	204.6	148.0	236.0	144.0
231	99.0	101.0	1.4	1.1	1.4	.8	1.4	1.9	.6	89.0	86.0	91.0
232	266.0	87.3	86.3	90.7	264.3	72.9	122.0	29.0	223.9	141.0	242.0	1.0
241	77.0	123.0	.7	1.5	1.2	.7	.9	1.0	1.7	90.0	93.5	94.5
242	278.0	89.7	93.0	91.3	274.0	48.0	102.0	24.0	174.0	109.0	232.0	929.0
251	81.0	119.0	.8	1.5	1.2	1.0	.9	.8	1.6	88.5	92.0	93.5
252	274.0	88.7	92.0	92.3	273.0	50.2	94.0	21.0	165.2	110.0	229.0	361.0
261	96.0	104.0	.8	1.1	1.1	.7	1.5	.5	1.0	89.5	90.0	90.0
262	269.5	90.0	88.7	88.3	267.0	24.5	96.0	20.0	140.5	127.0	231.0	16.0

271	72.0	128.0	.02	1.8	1.4	.05	1.0	1.6	1.1	84.5	92.5	90.5
272	267.5	85.7	90.0	88.3	264.0	120.5	90.0	14.0	224.5	112.0	240.0	784.0
281	88.0	112.0	1.0	1.0	1.2	.07	1.2	1.0	1.7	88.0	86.0	89.5
282	263.5	86.3	87.0	87.0	260.3	72.2	112.0	29.0	213.2	134.0	246.0	144.0
291	108.0	92.0	1.1	1.3	1.6	.09	1.3	2.0	.7	87.0	90.5	90.5
292	268.0	86.7	86.7	91.0	264.3	72.7	107.0	21.0	200.7	134.0	226.0	64.0
301	99.0	101.0	.09	1.3	1.4	.05	1.3	1.8	.7	89.0	90.0	91.0
302	270.0	90.0	89.7	89.3	269.0	46.7	103.0	14.0	163.7	129.0	230.0	1.0
311	90.0	110.0	1.0	1.5	.07	.09	.13	1.0	.09	90.5	90.0	90.5
312	271.0	89.0	90.0	89.3	268.3	45.6	106.0	20.0	171.6	129.0	239.0	100.0
321	87.0	113.0	.07	1.4	.03	1.1	.06	.02	.09	91.5	91.5	89.0
322	272.0	89.7	91.3	88.0	269.0	58.7	97.0	20.0	175.7	126.0	239.0	169.0
331	89.0	111.0	.06	1.7	.08	.06	.07	.08	.07	87.5	88.5	88.5
332	264.5	88.0	89.3	87.3	264.7	28.9	98.0	18.0	144.9	128.0	239.0	121.0
341	88.0	112.0	.06	1.4	1.1	.04	.08	.06	1.8	88.0	90.0	89.5
342	267.5	90.0	92.0	89.0	271.0	78.0	88.0	.9.0	175.0	118.0	230.0	144.0
351	115.0	85.0	1.8	.04	1.1	1.2	1.4	1.7	1.4	90.5	85.5	90.0
352	266.0	89.0	86.3	90.0	265.3	68.8	117.0	27.0	212.5	147.0	232.0	225.0
361	106.0	98.0	1.1	1.3	1.3	.07	1.2	1.9	.05	90.0	91.5	93.0
362	274.5	91.3	90.7	91.3	273.3	99.6	107.0	13.0	219.6	127.0	222.0	26.0
371	113.0	87.0	.06	1.7	1.1	.06	.09	1.7	.06	89.0	92.0	91.5
372	272.5	88.7	91.0	90.0	269.7	58.9	103.0	17.0	178.9	122.0	209.0	169.0

Appendix E

The discriminant analysis as described in the Results Chapter 4 are contained in the following pages. If the identification is insufficient, more information may be found in BMD Biomedical Computer Programs (Dixon, 1974 p. 211). Group 1 refers to the clinically diagnosed emotionally disturbed group. "Variables used in function" refer to the scored data produced by the MBD equations in Chapter 3 and have the same number as those equations.

1BPD044 - DISCRIMINANT ANALYSIS-TWO GROUPS - VERSION OF JUNE 9, 1966
HEALTH SCIENCES COMPUTING FACILITY, UCLA

0 PROBLEM NO. 04
NUMBER OF VARIABLES 24
VARIABLE FORMAT IS
(4X,12F6.1)

0 VARIABLE MEANS BY GROUP AND DIFFERENCE IN MEANS

VARIABLE	MEAN 1	MEAN 2	DIFFERENCE
1	97.48683	98.91891	-1.43208
2	102.81315	101.08107	1.73208
3	.97631	.94894	.02737
4	1.09342	1.17297	-.07955
5	1.07631	1.15945	-.08314
6	.91052	.83243	.07809
7	1.04999	1.13783	-.08784
8	1.11841	1.30945	-.24104
9	.94999	.85675	.09324
10	90.78946	89.04053	1.74893
11	91.03946	89.18216	1.85730
12	91.44078	90.16216	1.27863
13	273.26353	268.35475	4.90879
14	90.88025	88.79991	1.72034
15	90.69011	88.78639	1.90372
16	90.95734	89.67560	1.28174
17	272.17773	267.26660	4.91113
18	68.22989	66.32426	1.90562
19	102.56578	103.97296	-1.40718
20	21.17105	21.37837	-.20732
21	191.96622	191.67514	.29108
22	126.13158	131.29324	-.81166
23	228.64473	232.32431	-3.67958
24	298.96043	187.83783	111.12262

0 SUM OF PRODUCTS OF DEV. FROM MEANS

29148.00000	-29147.00000	457.60547	-532.55078	1044.76172	132.80469	483.06250
803.26953	-696.38281	2113.00000	-2860.31250	-1414.62500	-2166.00000	1758.50000
-3098.06250	847.00000	-808.00000	1522.75000	10176.00000	2149.87500	13848.00000
20806.00000	-8561.00000	-106141.00000				
-29147.00000	29148.00000	-457.60547	532.51562	-1044.73828	-132.81250	-483.06250
-803.30859	696.36328	-2112.68750	2860.48750	1415.50000	2159.00000	-1749.37500
3104.93750	-841.06250	808.00000	-1521.37500	-10174.00000	-2149.75000	-13845.00000

-20585.00000	8564.00000	106143.00000	-14.30550	2.68878	4.82410	10.59615
457.60547	-457.60547	15.72969	-87.09766	-2.92578	-54.27734	19.17578
9.25270	-8.58611	35.78391	117.38672	337.34766	149.06641	603.84375
-78.63281	13.68750	-45.79297				
415.15531	-42.39453	-1704.47656	17.78024	-1.68182	-6.57191	-11.01662
-532.55078	532.51562	-14.30550	91.27734	23.77344	77.95703	-27.10156
-5.63066	10.11218	-37.12891	-37.21875	-255.67188	-137.23315	-430.05859
81.64844	-2.72266	51.87500				
-457.60547	74.95312	1537.94141	-1.68182	10.72/17	-5.07202	6.03725
104.76172	-104.73828	2.68678	-20.78906	-11.68/50	-32.48828	-12.43750
14.63306	-43565	-23.41406	65.83984	125.16416	8.87817	199.92969
-33.67187	17.80859	-28.21875				
85.66797	-19.06641	-1213.78953	-6.57191	-5.07202	8.67299	0.08499
132.80469	-132.81250	4.82410	-20.98828	-8.35156	-14.18750	4.11719
-5.92855	-2.35777	15.11719	-5.43750	9.86719	72.11108	73.55078
-12.37500	5.81641	-2.89469				
95.99219	-36.80859	505.94141	-11.01662	6.03725	0.08499	14.53763
483.06250	-453.06250	10.59615	-64.16797	1.10547	-23.60156	32.36328
12.13742	-14.60896	39.43750	85.67969	280.18750	103.92187	472.82031
-80.13672	8.80859	-39.03906				
366.63672	-86.42188	-2218.80078	-5.63066	14.63306	-5.92558	12.13742
-503.26953	-503.30859	-9.20270	-87.61719	-4.29897	-55.23203	2.19531
34.32420	-14.67424	6.49609	173.26562	388.13281	43.83179	605.32422
-82.79297	34.08594	-46.30719				
423.36328	-79.88472	-5217.94531	10.11218	43565	-2.35777	-14.60896
-696.38281	696.36328	-8.58611	53.30859	35.97656	-4.87031	-71.98437
-14.67424	42.26114	-93.90234	-91.89453	-327.00000	-106.64258	-525.48828
89.48047	10.87891	28.16406				
-571.91406	124.46484	3000.50781	-37.12891	-23.41406	15.11719	39.43750
2113.00000	-2112.68750	35.75391	60.37500	169.56250	899.00000	532.12500
6.49609	-93.90234	676.43750	159.68750	1174.90000	460.25000	1792.00000
34.18750	194.25000	747.00000				
-994.50000	-1123.00000	-2601.00000	31.27734	-20.78906	-20.98828	-64.16797
-2860.31250	2860.68750	-87.09766	890.90000	324.62000	1271.00000	128.50000
-57.61719	53.30859	60.37500	-1251.25000	-2039.00000	-952.75000	-4243.00000
771.75000	177.25000	1065.00000				
-3481.50000	-623.00000	11323.00000	23.77344	11.68750	-8.38156	1.10547
-1414.62500	1415.50000	-2.92578	324.62500	609.25000	1098.00000	152.50000
-4.29297	35.97656	169.56250	338.18750	325.00000	398.56250	1059.00000
349.43750	332.12500	824.00000				
-2089.50000	-676.00000	6090.00000				

-2166.00000	2159.00000	=54.27734	77.95703	=32.48828	=14.18750	=23.60156
=55.33203	=4.57031	899.00000	1271.00000	1098.00000	3274.00000	807.00000
1147.00000	698.00000	2644.00000	=756.00000	=545.00000	=94.00000	=1400.00000
=4584.00000	=2423.00000	14807.00000				
1758.80000	=1749.37500	19.17578	=27.10156	=12.43750	4.11719	32.36328
2.19531	=71.98437	532.12500	128.50000	152.50000	807.00000	503.56250
104.68750	182.25000	777.00000	=326.43750	478.81250	32.43750	188.00000
497.12500	=1258.00000	=989.00000				
=3098.06250	3104.93750	=78.63281	81.64844	=33.67187	=12.37500	=80.13672
=82.79297	89.48047	34.18750	771.75000	349.43750	1147.00000	104.68750
843.87500	192.31250	1125.00000	=1253.68750	=2036.56250	=823.81250	=4110.00000
=3662.12500	=563.00000	16222.00000				
547.00000	=541.06250	13.68750	=2.72266	17.80859	5.81641	8.80859
34.08894	10.87891	194.25000	177.25000	332.12500	698.00000	182.25000
192.31250	411.68750	771.00000	576.37500	361.06250	121.00000	1060.00000
=617.62500	=1166.00000	336.00000				
=808.00000	805.00000	=45.79297	51.87500	=28.21875	=2.55469	=39.03906
=46.36719	28.16406	747.00000	1065.00000	824.00000	2644.00000	777.00000
1125.00000	771.00000	2685.00000	=1018.00000	=1206.00000	=667.81250	=2884.00000
=3804.00000	=2993.00000	15634.00000				
1822.75000	=1521.37500	117.38672	=37.21875	65.83384	=8.43750	88.67969
173.26562	=91.89453	159.68750	=1281.25000	338.18750	=756.00000	=326.43750
=1253.68750	876.37500	=1018.00000	104721.43750	7890.87500	2834.93750	115454.25000
4806.80000	3284.00000	519398.00000				
10176.00000	=10174.00000	337.34766	=255.67188	125.16016	9.86719	280.18750
388.13281	=327.00000	1174.80000	=2039.00000	325.00000	=545.00000	478.81250
=2036.56250	361.06250	=1206.00000	7890.87500	11860.00000	4850.12500	24599.00000
10514.00000	340.00000	=57050.00000				
2149.87500	=2149.75000	149.06641	=137.23315	8.87817	72.11108	103.92187
43.83179	=106.64258	460.25000	=982.75000	398.56250	=94.00000	32.43750
=823.81250	121.50000	=667.81250	2834.93750	4850.12500	3771.48047	11456.37500
3060.93750	911.25000	=8144.00000				
13848.00000	=13848.00000	603.84375	=430.05859	199.92269	73.85078	472.82031
605.32422	=525.48828	1792.00000	=4243.00000	1059.00000	=1400.00000	188.00000
=4110.00000	1060.00000	=2884.00000	115454.25000	24599.00000	11456.37500	151511.00000
18377.00000	4525.00000	454197.00000				
20586.00000	=20585.00000	415.19531	=457.60547	85.66797	95.99219	366.63672
423.36328	=571.91406	994.80000	=3481.50000	=2089.50000	=4584.00000	497.12500
=3662.12500	=617.62500	=3804.00000	4806.80000	10514.00000	3060.93750	18377.00000
20810.00000	225.00000	=91434.00000				
=8561.00000	8564.00000	=42.37453	74.98312	=19.06541	=36.80859	=86.42188

=79.88672	124.46484	=1123.00000	=623.00000	=676.00000	=2423.00000	=1258.00000
=563.00000	=1166.00000	=2993.00000	3284.00000	340.00000	911.25000	4525.00000
225.00000	8789.00000	14711.00000				
=106141.00000	106143.00000	=1704.47656	1537.34141	=1813.76553	505.94141	=2218.80078
=5217.94531	3000.50781	=2601.00000	11223.00000	6090.00000	14807.00000	=989.00000
16222.00000	336.00000	15634.00000	519398.00000	=57050.00000	=8144.00000	+54197.00000
=91434.00000	14711.00000	10445563.00000				
0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS						
.15075	.04690	=.15469	=.19175	.12840	.42309	=.03525
.00841	.00248	.05788	.03006	=.13486	=.04502	.07777
=.09193	.03549	=.00887	.05833	.10284	.03456	=.05878
=.16536	.10259	=.00001				
.04700	.01510	=.17191	=.21666	.12079	.39866	=.10407
.01470	.00036	.03377	.00274	=.14460	=.01746	.10185
=.07522	.05925	=.03490	=.05143	=.00347	=.07603	.05095
=.09100	.03101	=.00000				
=.15497	=.17197	1.38769	.97610	.05812	=1.04298	.01000
=.03079	=.06997	=.10119	=.04903	.19817	.08041	=.08463
.26062	=.04890	=.02467	.09906	=.01171	.17662	=.09695
.09834	.01470	=.00005				
=.19196	=.21662	.97590	2.35296	.95376	.30943	.67182
.03847	.21912	=.11875	=.18680	.31215	.11637	=.07745
.49718	=.21883	=.00321	.02295	=.11400	.11662	=.02062
.18561	.02211	=.00001				
.12850	.12073	.08837	.95383	3.33931	2.66557	=.73387
=.32114	=.12041	.32082	=.28613	=.30813	.05672	.07339
.00937	=.09990	=.07785	.03846	.09141	=.03667	=.03807
=.11296	.00228	=.00006				
.42368	.39881	=1.04294	.30898	2.66612	4.12615	=.31397
.07225	.18940	.41129	=.12291	=.82320	=.10812	.22573
=.35363	=.13643	.01429	=.23908	=.05881	=.38554	.23751
=.27297	.02130	=.00001				
=.03524	=.10398	.00974	.67161	=.73371	=.31335	1.61157
.03609	.16193	=.14833	.02967	.19039	=.00298	=.14903
.29485	=.09477	.06918	=.07476	=.12200	=.02504	.07528
.03763	.07328	.00004				
.00843	.01474	=.03088	.03839	=.32109	.07245	.03608
.36193	.14949	=.00301	.00378	.01889	=.00568	.04076
=.02024	=.03797	.00436	=.03072	=.04191	=.01885	.03097
.00822	=.00880	.00003				
.00251	.00040	=.07005	.21904	=.12034	.15988	.16151

.14948	.19027	.01366	.01673	.02995	.00908	.02870
.00118	.04518	.01390	.03859	.00008	.02674	.03873
.00945	.00126	.00001				
.05786	.03372	.10102	.11860	.32075	.41094	.14831
.00302	.01367	.17870	.08487	.01145	.11479	.00605
.11432	.02097	.02816	.03339	.06280	.00975	.03365
.07306	.02339	.00001				
.03004	.00272	.04896	.18670	.28616	.12305	.02970
.00378	.01672	.05487	.16817	.08162	.13299	.01819
.10281	.02456	.05804	.00315	.01142	.00349	.00290
.04070	.02726	.00000				
.13507	.14466	.19621	.31237	.30831	.52328	.19062
.01896	.03001	.01157	.08156	.26036	.05488	.07789
.11251	.06046	.03215	.07915	.02612	.11606	.07856
.06956	.01112	.00001				
.04502	.01744	.08032	.11628	.05674	.10795	.00299
.00567	.00907	.11479	.13299	.05495	.12810	.01440
.09942	.03180	.05234	.00204	.01714	.01013	.00179
.05146	.02746	.00000				
.07788	.10192	.08472	.07762	.07252	.22594	.14917
.04072	.02868	.00598	.01815	.07794	.01436	.05324
.06749	.00588	.00517	.06188	.04438	.07267	.06168
.00214	.02467	.00000				
.09203	.07322	.26051	.45715	.00333	.39339	.29493
.02019	.00114	.11439	.10284	.11240	.09946	.06739
.22896	.02627	.02843	.03893	.01819	.07323	.03812
.09891	.01605	.00000				
.03532	.05927	.04893	.21889	.09946	.13637	.09483
.03798	.04519	.02094	.02454	.06047	.03178	.00588
.02630	.05133	.01891	.00271	.00962	.01062	.00245
.01093	.02322	.00000				
.00888	.03491	.02463	.00316	.07757	.01419	.06921
.00436	.01390	.02815	.05804	.03218	.08233	.00519
.02840	.01851	.02801	.00560	.00034	.00448	.00593
.02927	.02645	.00000				
.05826	.05150	.09919	.02309	.03837	.23935	.07471
.03072	.03859	.03335	.00318	.07922	.00207	.06190
.03902	.00271	.00562	.04164	.01910	.04780	.04139
.00569	.11014	.00000				
.10282	.00953	.01156	.11389	.09137	.05910	.12200
.04193	.04810	.06280	.01142	.02621	.01713	.04443

-.01812	.00561	-.00035	.01921	.01794	.01149	-.01927
-.11840	.11241	-.00000				
.03446	-.07610	.17674	.11678	-.03677	-.38577	-.02495
-.01883	-.02673	.00969	-.00352	.11611	.01017	-.07267
.07332	-.01062	-.00450	.04779	.01144	.06569	-.04736
-.06782	.11093	-.00000				
-.05871	.05102	-.03709	-.02077	-.03799	.23778	.07523
.03096	.03873	-.01361	.00292	-.07863	-.00182	.06170
-.03820	.00245	.00554	-.04139	-.01924	-.04738	.04116
.08598	-.11012	.00000				
-.16332	-.09091	.03809	.15541	-.11285	-.27208	.03764
.00523	.00947	-.07307	-.04073	.06339	.05147	-.00305
.09883	.01056	-.02928	-.08573	-.11939	-.06788	.08602
.11669	-.07353	.00001				
.10249	.03091	.01493	.02234	.00811	.02086	.07335
-.00578	.00127	.02335	.02726	.01127	-.02745	-.02471
-.01594	-.02324	.02644	.11014	.11236	.11096	-.11012
-.07347	.07160	-.00000				
-.00001	-.00000	-.00005	-.00001	-.00006	-.00001	.00004
.00003	.00001	-.00001	.00000	.00001	.00000	.00000
.00000	.00000	.00000	-.00000	-.00000	-.00000	.00000
.00001	-.00000	.00000				
0 DISCRIMINANT FUNCTION	COEFFICIENTS					
-.01995	.01991	-.03488	.14761	.02393	.02388	-.10328
-.02581	-.01877	.01720	.01700	-.03017	.01087	.01128
-.04168	.01319	.00222	-.00418	.00709	-.01173	.00403
-.01606	.00028	.00000				

C PAMALANOBIS DSQUARE= 3.27270

C F(24, 88)= 2.69024

C PCP NO. SAMPLE SIZE

1 76

2 37

0 FIRST GROUP

RANK VALUES

1 -.82999

2 -.84309

3 -.84490

4 -.85192

5 -.85410

6 -.85496

7 -.85547

MEAN Z

-.87666

-.70613

SECOND GROUP

VALUES

VARIANCE Z

.00028

.00021

FIRST GROUP

ITEM NO.

23

18

66

1

5

26

3

STD. DEV. Z

.01682

.01438

SECOND GROUP

ITEM NO.

8	□.85576		15	
9	□.85681		11	
10	□.85796		32	
11	□.85840		29	
12	□.85962		7	
13	□.86036		45	
14	□.86127		21	
15	□.86166		76	
16	□.86183		13	
17	□.86256		51	
18	□.86290		46	
19	□.86304		35	
20	□.86487		75	
21	□.86549		16	
22	□.86601		9	
23	□.86691		74	
24	□.86739		30	
25	□.86756		22	
26	□.86811		52	
27	□.86886		10	
28	□.86955		63	
29		□.87077		19
30	□.87086		64	
31	□.87130		67	
32	□.87200		34	
33	□.87225		19	
34	□.87267		12	
35		□.87396		34
36	□.87408		55	
37	□.87540		17	
38	□.87571		27	
39	□.87592		28	
40	□.87698		54	
41	□.87769		14	
42		□.87855		32
43	□.87943		33	
44	□.87980		58	
45	□.87985		60	
46	□.88055		44	
47	□.88121		2	
48	□.88211		65	

49	□.88236		42	
50	□.88261		37	
51	□.88304		50	
52	□.88317		38	
53	□.88438		25	
54	□.88482		24	
55	□.88485		20	
56	□.88502		57	
57		□.88507		9
58	□.88559		62	
59	□.88591		59	
60	□.88634		47	
61	□.88684		68	
62	□.88781		4	
63	□.88842		39	
64		□.88862		24
65	□.88872		56	
66	□.89006		72	
67	□.89117		31	
68	□.89187		36	
69	□.89234		49	
70	□.89246		48	
71	□.89313		53	
72		□.89495		2
73		□.89546		10
74		□.89632		12
75	□.89650		70	
76		□.89710		36
77		□.89714		7
78	□.89762		8	
79	□.89765		41	
80		□.89923		25
81	□.90108		71	
82		□.90118		17
83		□.90195		29
84		□.90219		11
85	□.90234		73	
86		□.90317		15
87		□.90383		35
88	□.90518		40	
89		□.90580		27

90		0.90603		26
91	0.90622		61	
92		0.90662		4
93	0.90691		43	
94	0.90755		6	
95		0.90915		31
96		0.91075		14
97		0.91163		28
98		0.91218		23
99		0.91277		6
100		0.91415		3
101		0.91483		22
102	0.91586		69	
103		0.91624		5
104		0.91696		37
105		0.91742		1
106		0.91793		8
107		0.92142		33
108		0.92175		13
109		0.92244		21
110		0.92281		30
111		0.92292		16
112		0.92610		20
113		0.92742		18

0
SELECTION NO. 1
VARIABLES USED IN FUNCTION

1
0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.00003

0 DISCRIMINANT FUNCTION COEFFICIENTS
.00005

0 MAHALANOBIS DSQUARE= .00781

0 F(1,111)= .19435

0 POP. NO. SAMPLE SIZE

1	76
2	37

MEAN Z

0.00479

0.00486

VARIANCE Z

0.00000

0.00000

STD. DEV. Z

0.00085

0.00068

0 FIRST GROUP

SECOND GROUP

FIRST GROUP SECOND GROUP

RANK

VALUES

VALUES

ITEM NO.

ITEM NO.

1

0.00305

46

2	□.00314		55	
3	□.00324		4	
4	□.00344		74	
5	□.00354		15	
6		□.00354		27
7	□.00364		5	
8	□.00364		45	
9	□.00364		73	
10	□.00368		42	
11	□.00368		66	
12		□.00368		14
13		□.00378		24
14	□.00383		13	
15	□.00388		30	
16	□.00393		22	
17	□.00393		28	
18	□.00393		76	
19		□.00398		25
20	□.00403		56	
21	□.00403		62	
22	□.00408		40	
23	□.00413		14	
24	□.00413		68	
25		□.00413		13
26	□.00418		20	
27	□.00418		33	
28		□.00423		12
29	□.00427		18	
30		□.00427		32
31	□.00432		60	
32		□.00432		28
33		□.00432		34
34	□.00437		47	
35	□.00437		70	
36		□.00437		17
37		□.00437		33
38	□.00442		31	
39	□.00442		75	
40		□.00442		4
41		□.00442		31
42	□.00447		39	

43		□:00447		9
44	□:00452		26	
45	□:00457		54	
46	□:00457		72	
47		□:00457		8
48	□:00462		43	
49		□:00462		10
50	□:00467		44	
51	□:00472		41	
52	□:00472		65	
53		□:00472		26
54	□:00477		8	
55	□:00477		16	
56	□:00481		6	
57	□:00481		10	
58	□:00481		64	
59		□:00486		23
60		□:00486		30
61	□:00491		9	
62		□:00491		16
63		□:00491		20
64	□:00496		32	
65	□:00496		57	
66		□:00496		1
67		□:00496		7
68	□:00501		38	
69	□:00511		27	
70	□:00516		1	
71	□:00516		25	
72	□:00516		35	
73	□:00516		49	
74	□:00516		53	
75		□:00516		21
76		□:00516		36
77	□:00521		69	
78	□:00526		34	
79	□:00526		36	
80	□:00531		21	
81		□:00531		29
82	□:00536		3	
83	□:00536		37	

84	□.00536		50	
85	□.00540		58	
86		□.00540		2
87		□.00545		5
88	□.00550		24	
89	□.00550		59	
90		□.00550		22
91	□.00555		12	
92		□.00555		37
93	□.00560		17	
94	□.00560		29	
95		□.00560		3
96		□.00560		11
97		□.00565		19
98		□.00565		35
99	□.00580		11	
100		□.00580		18
101	□.00585		71	
102	□.00590		61	
103	□.00590		67	
104		□.00590		15
105	□.00594		23	
106	□.00594		48	
107	□.00599		7	
108	□.00604		2	
109	□.00629		19	
110	□.00639		52	
111		□.00639		6
112	□.00644		51	
113	□.00658		63	

0

SELECTION NO: .2
VARIABLES USED IN FUNCTION

2

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00003

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00008

0 MAHALANOBIS DSQUARE= .00781

0 F(1,111)= .19435

O POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z	
1	76	.00504	.00000	.00085	
2	37	.00497	.00000	.00068	
O	RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
	1	.00678		46	
	2	.00668		55	
	3	.00658		4	
	4	.00639		74	
	5	.00629		15	
	6		.00629		27
	7	.00619		5	
	8	.00619		45	
	9	.00619		73	
	10	.00614		42	
	11	.00614		66	
	12		.00614		14
	13		.00604		24
	14	.00599		13	
	15	.00594		30	
	16	.00590		22	
	17	.00590		28	
	18	.00590		76	
	19		.00585		25
	20	.00580		56	
	21	.00580		62	
	22	.00575		40	
	23	.00570		14	
	24	.00570		68	
	25		.00570		13
	26	.00565		20	
	27	.00565		33	
	28		.00560		12
	29	.00555		18	
	30		.00555		32
	31	.00550		60	
	32		.00550		28
	33		.00550		34
	34	.00545		47	
	35	.00545		70	
	36		.00545		17

37		•00545		33
38	•00540		31	
39	•00540		75	
40		•00540		4
41		•00540		31
42	•00536		39	
43		•00536		9
44	•00531		26	
45	•00526		54	
46	•00526		72	
47		•00526		8
48	•00521		43	
49		•00521		10
50	•00516		44	
51	•00511		41	
52	•00511		65	
53		•00511		26
54	•00506		8	
55	•00506		16	
56	•00501		6	
57	•00501		10	
58	•00501		64	
59		•00496		23
60		•00496		30
61	•00491		9	
62		•00491		16
63		•00491		20
64	•00486		32	
65	•00486		57	
66		•00486		1
67		•00486		7
68	•00481		38	
69	•00472		27	
70	•00467		1	
71	•00467		25	
72	•00467		35	
73	•00467		49	
74	•00467		53	
75		•00467		21
76		•00467		36
77	•00462		69	

78	.00457		34	
79	.00457		36	
80	.00452		21	
81		.00452		29
82	.00447		3	
83	.00447		37	
84	.00447		50	
85	.00442		58	
86		.00442		2
87		.00437		5
88	.00432		24	
89	.00432		59	
90		.00432		22
91	.00427		12	
92		.00427		37
93	.00423		17	
94	.00423		29	
95		.00423		3
96		.00423		11
97		.00418		19
98		.00418		35
99	.00403		11	
100		.00403		18
101	.00398		71	
102	.00393		61	
103	.00393		67	
104		.00393		15
105	.00388		23	
106	.00388		48	
107	.00383		7	
108	.00378		2	
109	.00354		19	
110	.00344		52	
111		.00344		6
112	.00339		51	
113	.00324		63	

0

SELECTION NO. 3
 VARIABLES USED IN FUNCTION
 3

O INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.06357

O DISCRIMINANT FUNCTION COEFFICIENTS

.00193

O MAHALANOBIS DSQUARE=

.00651

O F(1,111)=

.16196

O POP. NO.

SAMPLE SIZE

MEAN Z

VARIANCE Z

STD. DEV. Z

1

76

.00188

.00000

.00071

2

37

.00183

.00000

.00076

O

RANK

FIRST GROUP
VALUES

SECOND GROUP
VALUES

FIRST GROUP
ITEM NO.

SECOND GROUP
ITEM NO.

1

.00348

7

35

2

.00309

3

.00309

12

4

.00309

17

5

.00309

81

6

.00309

76

7

.00309

22

8

.00290

10

9

.00290

23

10

.00290

29

11

.00290

82

12

.00290

57

13

.00290

69

14

.00290

6

15

.00290

11

16

.00290

15

17

.00270

1

18

.00270

3

19

.00270

8

20

.00270

21

21

.00270

1

22

.00270

23

23

.00251

2

24

.00251

34

25

.00251

48

26

.00251

58

27

.00251

59

28

.00251

61

29

.00251

18

30

.00251

19

31	•00232		6	
32	•00232		25	
33	•00232		35	
34	•00232		44	
35	•00232		47	
36	•00232		84	
37	•00232		67	
38		•00232		3
39		•00232		21
40	•00212		19	
41	•00212		26	
42	•00212		63	
43		•00212		5
44		•00212		7
45		•00212		29
46		•00212		36
47	•00193		11	
48	•00193		16	
49	•00193		24	
50	•00193		32	
51	•00193		40	
52	•00193		93	
53	•00193		71	
54		•00193		28
55		•00193		31
56	•00174		13	
57	•00174		27	
58	•00174		33	
59	•00174		36	
60	•00174		39	
61		•00174		8
62		•00174		16
63		•00174		30
64	•00154		4	
65	•00154		18	
66	•00154		28	
67	•00154		37	
68	•00154		42	
69	•00154		50	
70	•00154		62	
71	•00154		73	

72		•00154		2
73		•00154		4
74		•00154		9
75		•00154		25
76		•00154		26
77	•00135		5	
78	•00135		15	
79	•00135		30	
80	•00135		41	
81	•00135		49	
82	•00135		60	
83	•00135		64	
84	•00135		68	
85	•00135		70	
86		•00135		24
87		•00135		32
88	•00116		9	
89	•00116		14	
90	•00116		66	
91	•00116		72	
92	•00116		74	
93		•00116		17
94		•00116		20
95		•00116		33
96		•00116		34
97		•00116		37
98	•00097		20	
99	•00097		31	
100	•00097		38	
101	•00097		46	
102	•00097		65	
103	•00097		75	
104		•00097		12
105	•00077		22	
106	•00077		43	
107	•00077		48	
108	•00077		56	
109		•00077		10
110		•00077		13
111	•00058		55	
112		•00058		14

113

.00039

27

0

SELECTION NO: 4
VARIABLES USED IN FUNCTION

4

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.05624

0 DISCRIMINANT FUNCTION COEFFICIENTS
=.00447

0 MAHALANOBIS DSQUARE=.03951

0 F(1,111)=.98318

0 POP. NO. SAMPLE SIZE

MEAN Z

VARIANCE Z

STD. DEV. Z

1

76

=.00489

.00000

.00173

2

37

=.00525

.00000

.00191

0

RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1				16
2	=.00179		12	
3	=.00179		17	
4	=.00179		19	
5	=.00179		23	
6		=.00179		35
7	=.00224		76	
8		=.00224		18
9		=.00224		19
10		=.00224		22
11	=.00268		3	
12	=.00268		11	
13	=.00268		61	
14	=.00268		67	
15	=.00268		69	
16		=.00268		11
17	=.00313		1	
18	=.00313		2	
19	=.00313		7	
20	=.00313		10	
21	=.00313		34	
22	=.00313		62	
23	=.00313		61	
24	=.00313		71	

155

25		□:00313		5
26		□:00313		6
27	□:00358		8	
28	□:00358		21	
29	□:00358		35	
30	□:00358		47	
31	□:00358		48	
32	□:00358		58	
33	□:00403		16	
34	□:00403		18	
35	□:00403		25	
36	□:00403		29	
37	□:00403		44	
38	□:00403		49	
39	□:00403		54	
40	□:00403		57	
41	□:00403		63	
42		□:00403		3
43		□:00403		21
44	□:00447		26	
45	□:00447		37	
46	□:00447		59	
47	□:00447		64	
48		□:00447		1
49		□:00447		16
50		□:00447		28
51	□:00492		6	
52	□:00492		24	
53	□:00492		33	
54	□:00492		75	
55		□:00492		2
56		□:00492		23
57		□:00492		26
58	□:00537		4	
59	□:00537		30	
60	□:00537		53	
61		□:00537		7
62		□:00537		9
63	□:00582		9	
64	□:00582		13	
65	□:00582		27	

66	□.00582	32	
67	□.00582	36	
68	□.00582	43	
69	□.00582	62	
70	□.00582	70	
71			20
72		□.00582	29
73		□.00582	30
74		□.00582	36
75	□.00626		
76	□.00626	31	
77	□.00626	38	
78	□.00626	42	
79	□.00626	50	
80		65	
81			4
82		□.00626	10
83		□.00626	32
84	□.00671	□.00626	34
85	□.00671		
86	□.00671	5	
87	□.00671	18	
88	□.00671	28	
89	□.00671	39	
90	□.00671	40	
91	□.00671	41	
92	□.00671	46	
93	□.00671	60	
94		72	
95		73	
96			8
97		□.00671	12
98		□.00671	17
99		□.00671	24
100	□.00716	□.00671	25
101	□.00716	□.00671	31
102	□.00716		
103	□.00716	14	
104	□.00761	45	
105	□.00761	55	
106	□.00761	66	
		66	
		68	
		74	

107		=:00761		33
108		=:00761		37
109	=:00805		20	
110	=:00805		22	
111		=:00805		13
112		=:00805		27
113		=:00850		14

0

SELECTION NO: 5
VARIABLES USED IN FUNCTION

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.09322

0 DISCRIMINANT FUNCTION COEFFICIENTS
=:00775

0 MAHALANOBIS DSQUARE=:07153

0 F(1,111) = 1.78007

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	=:00834	=:00001	.00240
2	37	=:00899	=:00001	.00243

0	RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
	1		=:00233		32

2	=:00388	13
3	=:00465	28
4	=:00465	30
5	=:00465	31
6	=:00465	60
7	=:00465	64
8	=:00543	11
9	=:00543	14
10	=:00543	18
11	=:00543	17
12	=:00543	21
13	=:00543	22
14	=:00543	50
15	=:00543	62
16	=:00543	63
17	=:00543	12
18	=:00543	19

158

19		□•00543		31
20	□•00620		9	
21	□•00620		19	
22	□•00620		44	
23	□•00620		55	
24	□•00620		68	
25	□•00620		75	
26		□•00620		4
27		□•00620		33
28	□•00698		34	
29	□•00698		38	
30	□•00698		40	
31		□•00698		1
32		□•00698		6
33		□•00698		14
34	□•00775		4	
35	□•00775		5	
36	□•00775		10	
37	□•00775		12	
38	□•00775		20	
39	□•00775		23	
40	□•00775		46	
41	□•00775		47	
42	□•00775		48	
43	□•00775		62	
44	□•00775		63	
45	□•00775		61	
46		□•00775		16
47	□•00853		1	
48	□•00853		16	
49	□•00853		18	
50	□•00853		33	
51	□•00853		39	
52	□•00853		43	
53	□•00853		48	
54	□•00853		49	
55	□•00853		59	
56	□•00853		66	
57	□•00853		74	
58	□•00853		76	
59		□•00853		2

60		□.00853		3
61		□.00853		18
62		□.00853		22
63		□.00853		25
64		□.00853		26
65		□.00853		34
66		□.00853		35
67		□.00853		37
68	□.00930		2	
69	□.00930		3	
70	□.00930		27	
71	□.00930		67	
72	□.00930		71	
73	□.00930		72	
74	□.00930		73	
75		□.00930		21
76		□.00930		24
77		□.00930		28
78	□.01008		35	
79	□.01008		42	
80	□.01008		56	
81	□.01008		58	
82	□.01008		69	
83	□.01008		70	
84		□.01008		8
85		□.01008		17
86		□.01008		20
87		□.01008		36
88	□.01085		8	
89	□.01085		36	
90	□.01085		51	
91		□.01085		10
92		□.01085		11
93		□.01085		13
94		□.01085		15
95		□.01085		23
96		□.01085		27
97		□.01085		30
98	□.01163		7	
99	□.01163		24	
100	□.01163		29	

101	=.01163		32	
102	=.01163		41	
103	=.01163		54	
104	=.01163		57	
105		=.01163		6
106	=.01240		26	
107	=.01240		65	
108		=.01240		29
109	=.01318		6	
110	=.01318		37	
111		=.01318		7
112	=.01395		25	
113		=.01473		9

0

SELECTION NO: 6
VARIABLES USED IN FUNCTION

6

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.11530

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00900

0 MAHALANOBIS DSQUARE=

.07805

0 F(1,111)= 1.94224

0 POP. NO: SAMPLE SIZE

MEAN Z

VARIANCE Z

STD. DEV. Z

1

76

.00820

.00001

.00246

2

37

.00750

.00001

.00263

0

FIRST GROUP

SECOND GROUP

FIRST GROUP

SECOND GROUP

RANK

VALUES

VALUES

ITEM NO.

ITEM NO.

1

.01531

17

2

.01351

11

3

.01351

47

4

.01351

5

5

.01261

9

6

.01261

62

7

.01261

19

8

.01171

10

9

.01171

12

10

.01171

13

11

.01171

19

12

.01171

23

161

13	.01171		44	
14		.01171		22
15	.01080		30	
16	.01080		34	
17	.01080		50	
18		.01080		35
19	.00990		18	
20	.00990		58	
21	.00990		63	
22		.00990		1
23		.00990		3
24		.00990		12
25		.00990		16
26		.00990		18
27		.00990		21
28		.00990		32
29	.00900		1	
30	.00900		4	
31	.00900		8	
32	.00900		22	
33	.00900		28	
34	.00900		31	
35	.00900		33	
36	.00900		52	
37	.00900		60	
38	.00900		61	
39	.00900		67	
40	.00900		75	
41		.00900		15
42		.00900		25
43	.00810		2	
44	.00810		5	
45	.00810		14	
46	.00810		21	
47	.00810		26	
48	.00810		27	
49	.00810		42	
50	.00810		48	
51	.00810		49	
52	.00810		51	
53	.00810		53	

54	•00810		55	
55	•00810		57	
56	•00810		64	
57	•00810		70	
58	•00810		71	
59	•00810		76	
60		•00810		11
61		•00810		29
62		•00810		31
63	•00720		3	
64	•00720		7	
65	•00720		15	
66	•00720		25	
67	•00720		29	
68	•00720		35	
69	•00720		46	
70	•00720		59	
71	•00720		73	
72		•00720		2
73		•00720		6
74		•00720		17
75		•00720		23
76	•00630		6	
77	•00630		16	
78	•00630		40	
79	•00630		45	
80	•00630		68	
81	•00630		69	
82	•00630		72	
83	•00630		74	
84		•00630		4
85		•00630		7
86		•00630		20
87		•00630		24
88		•00630		26
89		•00630		28
90		•00630		36
91	•00540		20	
92	•00540		24	
93	•00540		36	
94	•00540		38	

95	.00540		43	
96	.00540		54	
97	.00540		66	
98		.00540		14
99		.00540		33
100		.00540		37
101	.00450		39	
102	.00450		41	
103	.00450		56	
104	.00450		65	
105		.00450		9
106		.00450		27
107		.00450		30
108	.00360		37	
109		.00360		8
110		.00360		10
111		.00360		13
112		.00360		34
113	.00270		32	

0

SELECTION NO: 7
VARIABLES USED IN FUNCTION
7

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.06879

0 DISCRIMINANT FUNCTION COEFFICIENTS
=.00604

0 MAHALANOBIS DSQUARE= .05891

0 F(1,111)= 1.46603

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	=.00634	.00001	.00232
2	37	=.00688	.00000	.00189

0	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
RANK				
1	=.00181		13	
2	=.00242		22	
3	=.00242		30	
4	=.00242		45	
5	=.00242		55	
6		=.00242		12

7	□.00302		14	
8	□.00302		20	
9	□.00302		66	
10	□.00363		15	
11	□.00363		46	
12	□.00363		62	
13	□.00363		75	
14		□.00363		32
15	□.00423		5	
16	□.00423		17	
17	□.00423		38	
18	□.00423		39	
19	□.00423		70	
20		□.00423		14
21		□.00423		33
22	□.00483		4	
23	□.00483		18	
24	□.00483		42	
25	□.00483		44	
26	□.00483		60	
27	□.00483		73	
28	□.00483		74	
29		□.00483		10
30		□.00483		34
31	□.00544		1	
32	□.00544		9	
33	□.00544		19	
34	□.00544		28	
35	□.00544		41	
36	□.00544		50	
37	□.00544		56	
38	□.00544		68	
39	□.00544		72	
40		□.00544		16
41		□.00544		24
42		□.00544		25
43		□.00544		31
44		□.00544		37
45	□.00604		26	
46	□.00604		31	
47	□.00604		33	

48	□•00604	36	
49	□•00604	40	
50	□•00604	47	
51	□•00604	64	
52	□•00604	65	
53		□•00604	2
54		□•00604	5
55		□•00604	8
56		□•00604	17
57		□•00604	27
58	□•00665	10	
59	□•00665	16	
60	□•00665	27	
61	□•00665	35	
62	□•00665	54	
63	□•00665	63	
64	□•00665	71	
65		□•00665	21
66	□•00725	8	
67	□•00725	21	
68	□•00725	43	
69	□•00725	53	
70	□•00725	58	
71	□•00725	59	
72		□•00725	1
73		□•00725	4
74		□•00725	13
75		□•00725	28
76		□•00725	36
77	□•00785	11	
78	□•00785	32	
79	□•00785	37	
80		□•00785	3
81		□•00785	7
82		□•00785	9
83		□•00785	19
84		□•00785	29
85		□•00785	30
86	□•00846	24	
87		□•00846	20
88		□•00846	22

89		=.00846	23
90		=.00846	35
91	=.00906		6
92	=.00906		12
93	=.00906		52
94	=.00906		57
95	=.00906		67
96		=.00906	6
97		=.00906	26
98	=.00967		3
99	=.00967		7
100	=.00967		23
101	=.00967		25
102	=.00967		29
103	=.00967		34
104	=.00967		48
105	=.00967		49
106	=.00967		61
107	=.00967		69
108	=.00967		76
109		=.00967	18
110	=.01027		51
111		=.01027	11
112	=.01088		2
113		=.01088	15

0

SELECTION NO: 8
 VARIABLES USED IN FUNCTION
 8

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .02913

0 DISCRIMINANT FUNCTION COEFFICIENTS
 =.00702

0 MAHALANOBIS DSQUARE= .18789

0 F(1,111) = 4.67557

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	=.00785	.00002	.00407
2	37	=.00955	.00001	.00354

0 RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
--------	-----------------------	------------------------	-------------------------	--------------------------

1	.00000		13	
2	.00000		30	
3	▣.00070		4	
4	▣.00070		55	
5	▣.00140		15	
6	▣.00140		64	
7		▣.00140		32
8	▣.00281		14	
9	▣.00281		18	
10	▣.00281		31	
11	▣.00281		47	
12	▣.00281		62	
13	▣.00351		11	
14	▣.00351		22	
15	▣.00351		46	
16	▣.00351		75	
17		▣.00351		12
18		▣.00351		26
19	▣.00421		5	
20	▣.00421		28	
21	▣.00421		44	
22		▣.00421		34
23	▣.00492		10	
24	▣.00492		40	
25	▣.00492		43	
26	▣.00492		60	
27		▣.00492		4
28		▣.00492		14
29	▣.00562		33	
30	▣.00562		34	
31	▣.00562		38	
32	▣.00562		45	
33	▣.00562		49	
34	▣.00562		68	
35		▣.00562		19
36		▣.00562		25
37		▣.00562		33
38	▣.00632		16	
39	▣.00632		17	
40	▣.00632		19	
41	▣.00632		21	

42	□.00632		23	
43	□.00632		63	
44	□.00632		66	
45	□.00702		9	
46	□.00702		73	
47		□.00702		24
48		□.00702		28
49		□.00702		31
50	□.00772		12	
51	□.00772		42	
52	□.00772		61	
53	□.00843		35	
54	□.00843		74	
55	□.00913		2	
56	□.00913		20	
57	□.00913		48	
58	□.00913		54	
59		□.00913		1
60		□.00913		13
61		□.00913		18
62		□.00913		21
63	□.00983		1	
64	□.00983		50	
65	□.00983		71	
66	□.00983		76	
67		□.00983		5
68	□.01053		3	
69	□.01053		6	
70	□.01053		26	
71		□.01053		17
72	□.01124		52	
73	□.01124		67	
74	□.01124		70	
75		□.01124		9
76		□.01124		16
77		□.01124		20
78		□.01124		22
79		□.01124		27
80	□.01194		65	
81	□.01194		69	
82		□.01194		2

83		=01194		10
84		=01194		35
85		=01194		37
86	=01264		8	
87	=01264		24	
88	=01264		27	
89	=01264		37	
90	=01264		39	
91	=01264		41	
92	=01264		53	
93	=01264		56	
94	=01264		57	
95	=01264		59	
96	=01264		72	
97		=01264		8
98		=01264		11
99		=01264		15
100		=01264		30
101	=01334		36	
102	=01334		51	
103	=01334		58	
104		=01334		3
105		=01334		6
106		=01334		23
107		=01334		36
108	=01404		7	
109	=01404		25	
110	=01404		29	
111	=01404		32	
112		=01404		7
113		=01404		29

SELECTION NO: 9
 VARIABLES USED IN FUNCTION
 9

0 INVERSE OF SUM OF PRODUCTS OF DEV: FROM MEANS
 .02366

0 DISCRIMINANT FUNCTION COEFFICIENTS
 .00221

0 MAHALANOBIS DSQUARES .02283

O F (1,111) =		.56823					
O POP NO	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD DEV	DEV		
1	76	.00210	.00000		.00145		
2	37	.00189	.00000		.00115		
RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO	SECOND GROUP ITEM NO			
1	.00441		10				
2	.00441		38				
3	.00441		44				
4	.00441		66				
5	.00419		18				
6	.00419		33				
7	.00419		42				
8	.00419		45				
9	.00419		46				
10	.00419		47				
11		.00419		12			
12	.00397		8				
13	.00397		14				
14	.00397		35				
15	.00397		54				
16		.00397		34			
17	.00375		4				
18	.00375		26				
19	.00375		55				
20		.00375		21			
21		.00375		24			
22		.00375		28			
23	.00353		15				
24	.00353		73				
25		.00353		9			
26		.00353		25			
27	.00331		62				
28	.00331		65				
29	.00309		6				
30	.00309		8				
31	.00309		70				
32		.00309		35			
33	.00287		17				
34	.00287		22				
35	.00287		30				

36	.00287		39	
37	.00287		40	
38	.00287		41	
39		.00287		14
40	.00265		13	
41	.00265		37	
42	.00243		69	
43	.00243		74	
44		.00243		13
45		.00243		27
46	.00221		28	
47		.00221		26
48	.00199		1	
49	.00199		75	
50		.00199		7
51		.00199		8
52		.00199		31
53		.00199		32
54	.00177		19	
55	.00177		31	
56	.00177		32	
57	.00177		71	
58		.00177		10
59		.00177		22
60	.00154		36	
61	.00154		56	
62	.00154		59	
63	.00154		64	
64	.00154		68	
65		.00154		4
66		.00154		29
67		.00154		30
68		.00154		33
69	.00132		20	
70	.00132		25	
71	.00132		57	
72	.00132		58	
73		.00132		1
74		.00132		23
75		.00132		37
76	.00110		29	

77		•00110	2
78		•00110	6
79		•00110	11
80		•00110	16
81		•00110	36
82	•00088		7
83	•00088		53
84	•00088		60
85	•00088		72
86		•00088	17
87	•00066		2
88	•00066		11
89	•00066		16
90	•00066		24
91	•00066		43
92	•00066		51
93	•00066		63
94		•00066	3
95		•00066	5
96	•00044		27
97	•00044		34
98	•00044		49
99	•00044		67
100		•00044	15
101		•00044	19
102	•00022		13
103	•00022		9
104	•00022		21
105	•00022		23
106	•00022		50
107	•00022		52
108	•00022		61
109	•00022		76
110		•00022	20
111	•00000		12
112	•00000		48
113		•00000	18

0

SELECTION NO. 10
VARIABLES USED IN FUNCTION

10
 O INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .00148
 O DISCRIMINANT FUNCTION COEFFICIENTS
 .00259
 O MAHALANOBIS DSQUARE= .50193
 O F(1,111)= 12.49044
 O POP. NO. SAMPLE SIZE MEAN Z VARIANCE Z STD. DEV. Z
 1 76 .23474 .00005 .00695
 2 37 .23021 .00003 .00500
 O RANK FIRST GROUP SECOND GROUP FIRST GROUP SECOND GROUP
 VALUES VALUES ITEM NO. ITEM NO.
 1 .25209 63
 2 .24980 52
 3 .24692 23
 4 .24692 19
 5 .24562 3
 6 .24433 11
 7 .24433 29
 8 .24433 76
 9 .24304 2
 10 .24304 21
 11 .24304 51
 12 .24174 7
 13 .24174 28
 14 .24174 34
 15 .24174 48
 16 .24174 53
 17 .24174 60
 18 .24174 64
 19 .24045 58
 20 .23916 10
 21 .23916 27
 22 .23916 32
 23 .23916 50
 24 .23916 59
 25 .23916 68
 26 .23916 4
 27 .23787 1
 28 .23787 9
 29 .23787 15

30	•23787		16	
31	•23787		67	
32	•23657		31	
33	•23657		61	
34	•23657		66	
35	•23657		75	
36		•23657		32
37	•23528		5	
38	•23528		12	
39	•23528		14	
40	•23528		38	
41	•23528		69	
42	•23528		72	
43	•23528		74	
44		•23528		2
45		•23528		3
46	•23399		19	
47	•23399		22	
48	•23399		24	
49	•23399		33	
50	•23399		36	
51		•23399		18
52		•23399		31
53		•23399		36
54	•23270		13	
55	•23270		18	
56	•23270		20	
57	•23270		26	
58	•23270		49	
59		•23270		7
60		•23270		11
61		•23270		16
62		•23270		24
63		•23270		36
64	•23140		35	
65	•23140		62	
66		•23140		15
67		•23140		26
68	•23011		37	
69	•23011		47	
70		•23011		8

71		•23011		10
72		•23011		23
73		•23011		30
74		•23011		37
75	•22882		26	
76	•22882		40	
77	•22882		54	
78	•22882		57	
79	•22882		65	
80	•22882		71	
81		•22882		14
82		•22882		20
83		•22882		21
84		•22882		25
85	•22752		17	
86	•22752		43	
87		•22752		9
88		•22752		13
89		•22752		28
90		•22752		34
91	•22623		6	
92	•22623		8	
93	•22623		30	
94	•22623		36	
95	•22623		39	
96	•22623		44	
97	•22623		45	
98	•22623		70	
99		•22623		6
100		•22623		12
101		•22623		22
102		•22623		33
103	•22494		46	
104		•22494		1
105		•22494		29
106	•22365		4	
107	•22365		55	
108	•22365		73	
109		•22365		5
110		•22365		17
111	•22235		41	

112 .22106 42
 113 .21848 27
 0

SELECTION NO: 11
 VARIABLES USED IN FUNCTION
 11

0 INVERSE OF SUM OF PRODUCTS OF DEV: FROM MEANS
 .00112

0 DISCRIMINANT FUNCTION COEFFICIENTS
 .00211

0 MAHALANOBIS DSQUARE: .43930

0 F(1,111): 10.93188

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.19192	.00003	.00562
2	37	.18797	.00004	.00664

RANK	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP
	VALUES	VALUES	ITEM NO.	ITEM NO.
1	.20344		45	
2	.20238		22	
3	.20238		66	
4	.20133		74	
5	.20027		8	
6	.20027		15	
7	.20027		55	
8	.19817		9	
9	.19817		28	
10	.19817		29	
11	.19817		50	
12	.19817		56	
13	.19817		65	
14	.19817		72	
15	.19817		75	
16	.19711		14	
17	.19711		60	
18	.19711		68	
19		.19711		12
20		.19711		24
21	.19606		31	
22	.19606		46	
23		.19606		14

24	.19500		11	
25	.19500		18	
26	.19500		20	
27	.19500		27	
28	.19500		62	
29		.19500		27
30	.19395		23	
31	.19395		26	
32	.19395		32	
33	.19395		38	
34	.19395		64	
35		.19395		4
36		.19395		7
37		.19395		9
38		.19395		13
39		.19395		25
40		.19395		37
41	.19290		3	
42	.19290		33	
43	.19290		34	
44	.19290		53	
45	.19290		63	
46		.19290		10
47		.19290		19
48		.19290		32
49		.19290		36
50	.19184		13	
51	.19184		39	
52	.19184		42	
53	.19184		47	
54	.19184		89	
55	.19184		70	
56	.19079		4	
57	.19079		10	
58	.19079		16	
59	.19079		25	
60	.19079		30	
61	.19079		43	
62		.19079		20
63		.19079		29
64	.18973		1	

65	•18973	37	
66	•18973	40	
67	•18973	41	
68	•18973	49	
69	•18973	58	
70	•18973	67	
71	•18973	73	
72		•18973	17
73		•18973	26
74		•18973	30
75		•18973	31
76		•18973	34
77	•18868	82	
78		•18868	2
79	•18762	21	
80	•18762	24	
81	•18762	36	
82	•18762	54	
83	•18657	6	
84	•18657	7	
85	•18657	35	
86	•18657	44	
87	•18657	51	
88		•18657	16
89		•18657	33
90	•18552	2	
91	•18552	12	
92	•18552	19	
93		•18552	3
94		•18552	8
95	•18446	48	
96	•18341	8	
97	•18341	57	
98	•18341	71	
99		•18341	21
100	•18235	69	
101	•18130	17	
102		•18130	1
103		•18130	23
104		•18130	28
105		•18026	18

106		.18025		35
107	.17919		76	
108		.17919		5
109		.17919		15
110	.17814		61	
111		.17603		11
112		.17603		22
113		.17287		6

0

SELECTION NO: 12
VARIABLES USED IN FUNCTION
12

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00164

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00210

0 MAHALANOBIS DSQUARE= .29786

0 F(1,111)= 7.41226

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.19191	.00002	.00495
2	37	.18922	.00002	.00481

0	RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
	1	.20252		74	
	2	.20147		29	
	3	.20147		66	
	4	.20042		18	
	5	.20042		26	
	6	.19938		33	
	7	.19833		10	
	8	.19833		47	
	9	.19833		87	
	10		.19833		21
	11		.19833		24
	12	.19728		18	
	13	.19728		28	
	14	.19728		86	
	15	.19728		88	
	16	.19728		62	
	17	.19728		68	

18	.19623		59	
19	.19623		60	
20		.19623		25
21	.19518		3	
22	.19518		6	
23	.19518		18	
24	.19518		23	
25		.19518		4
26		.19518		9
27		.19518		36
28	.19413		7	
29	.19413		14	
30	.19413		73	
31	.19413		76	
32	.19308		2	
33	.19308		4	
34	.19308		20	
35	.19308		22	
36	.19308		25	
37	.19308		34	
38	.19308		46	
39	.19308		51	
40	.19308		52	
41	.19308		54	
42		.19308		7
43		.19308		11
44		.19308		13
45	.19203		1	
46	.19203		9	
47	.19203		11	
48	.19203		13	
49	.19203		65	
50		.19203		14
51		.19203		37
52	.19098		21	
53	.19098		27	
54	.19098		31	
55	.19098		32	
56	.19098		35	
57	.19098		42	
58	.19098		53	

59	•19098	69	
60	•19098	70	
61	•19098	72	
62		•19098	17
63		•19098	23
64		•19098	30
65	•18993	16	
66	•18993	50	
67	•18993	64	
68		•18993	19
69		•18993	27
70		•18993	29
71		•18993	31
72	•18888	8	
73	•18888	12	
74	•18888	40	
75	•18888	46	
76	•18888	48	
77	•18888	75	
78		•18888	3
79		•18888	8
80		•18888	18
81		•18888	26
82		•18888	35
83	•18783	41	
84	•18783	55	
85	•18783	63	
86		•18783	10
87		•18783	28
88		•18783	34
89	•18678	39	
90	•18678	49	
91		•18678	15
92		•18678	32
93	•18573	30	
94	•18573	37	
95	•18573	38	
96	•18573	43	
97	•18573	67	
98		•18573	20
99		•18573	33

100	.18468		24	
101	.18468		44	
102	.18468		61	
103		.18468		2
104		.18468		22
105	.18364		19	
106	.18259		71	
107		.18259		12
108		.18259		16
109	.18154		17	
110		.18049		6
111	.17944		36	
112		.17944		1
113		.17944		5

0

SELECTION NO. 13
VARIABLES USED IN FUNCTION
13

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.00031

0 DISCRIMINANT FUNCTION COEFFICIENTS
.00150

0 MAHALANOBIS DSQUARE. .81561

0 F(1,111) = 20.29646

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.40938	.00007	.00836
2	37	.40204	.00007	.00807

RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	.42621		29	
2	.42471		66	
3	.42356		74	
4	.42172		9	
5	.42172		28	
6	.42097		19	
7	.42022		23	
8	.42022		60	
9	.41947		68	
10	.41872		13	
11	.41722		11	

12	•41722		22	
13	•41722		86	
14	•41722		63	
15	•41647		62	
16		•41647		24
17	•415/2		9	
18	•415/2		10	
19		•41572		4
20		•41572		19
21	•41497		14	
22	•41497		33	
23	•41497		34	
24	•41497		50	
25	•41497		58	
26	•41497		59	
27	•41348		26	
28	•41348		27	
29	•41348		83	
30	•41348		62	
31	•41348		64	
32	•41348		72	
33	•41273		18	
34	•41273		31	
35	•41273		32	
36	•41273		75	
37	•41123		7	
38	•41123		20	
39	•41123		47	
40	•41123		51	
41		•41123		36
42	•41048		2	
43	•41048		21	
44	•41048		46	
45	•41048		65	
46		•41048		7
47		•41048		25
48	•40973		1	
49	•40898		16	
50		•40898		9
51		•40898		14
52	•40823		13	

53	•40823		25	
54		•40823		37
55	•40748		46	
56	•40748		76	
57		•40748		13
58		•40748		32
59	•40673		38	
60	•40999		48	
61	•40599		55	
62		•40599		31
63	•40924		67	
64	•40449		97	
65		•40449		10
66		•40449		21
67		•40449		30
68	•40374		54	
69	•40374		70	
70		•40374		26
71	•40299		4	
72	•40299		6	
73	•40299		12	
74	•40299		35	
75	•40299		49	
76	•40299		73	
77		•40299		3
78	•40224		40	
79	•40224		69	
80		•40224		2
81		•40149		12
82		•40149		29
83	•40074		24	
84	•40074		37	
85	•40074		39	
86	•40074		42	
87		•40074		17
88		•40074		20
89		•40074		27
90		•40074		34
91	•39999		43	
92		•39999		8
93	•39924		30	

94	.39849		19	
95		.39849		18
96		.39849		23
97		.39849		35
98	.39775		41	
99		.39775		11
100		.39775		16
101	.39625		8	
102		.39625		33
103	.39550		44	
104	.39550		61	
105		.39475		15
106		.39475		28
107	.39325		71	
108	.39250		36	
109	.39026		17	
110		.38801		22
111		.38726		1
112		.38501		5
113		.38276		6

0

SELECTION NO. 14
VARIABLES USED IN FUNCTION
14

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.00199

0 DISCRIMINANT FUNCTION COEFFICIENTS
.00342

0 MAHALANOBIS DSQUARES .65237

0 F(1,111) 16.23427

0 POP. NO. SAMPLE SIZE

1	76
2	37

MEAN Z
.20925
.30337

VARIANCE Z
.00006
.00004

STD. DEV. Z
.00776
.00608

0	FIRST GROUP RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
	1	.32899		63	
	2	.32694		23	
	3	.32353		52	
	4	.32216		11	
	5	.32216		29	

6	•32114		3	
7		•32114		19
8	•31874		2	
9	•31874		51	
10	•31772		59	
11	•31772		76	
12	•31669		21	
13	•31669		34	
14	•31669		64	
15	•31533		7	
16	•31533		48	
17	•31533		60	
18		•31533		4
19	•31430		16	
20	•31430		80	
21	•31430		67	
22	•31430		75	
23	•31328		38	
24	•31191		1	
25	•31191		9	
26	•31191		12	
27	•31191		18	
28	•31191		31	
29	•31191		32	
30	•31191		66	
31	•31191		68	
32		•31191		36
33	•31089		5	
34	•31089		10	
35	•31089		19	
36	•31089		28	
37	•31089		53	
38	•31089		88	
39	•31089		61	
40	•30986		14	
41	•30986		18	
42	•30986		22	
43	•30986		35	
44		•30986		7
45	•30849		20	
46	•30849		25	

47	•30849		27	
48	•30849		49	
49	•30849		56	
50	•30849		68	
51	•30849		69	
52	•30849		71	
53	•30849		72	
54	•30849		74	
55		•30849		18
56		•30747		2
57		•30747		15
58		•30747		26
59		•30747		30
60		•30747		34
61	•30644		24	
62	•30644		33	
63	•30644		37	
64		•30644		10
65		•30644		24
66		•30644		32
67	•30508		26	
68	•30508		43	
69		•30508		3
70		•30508		9
71		•30508		11
72	•30405		13	
73	•30405		45	
74	•30405		47	
75	•30405		54	
76		•30405		20
77		•30405		31
78		•30405		35
79	•30303		62	
80	•30303		70	
81		•30303		14
82		•30303		25
83		•30303		37
84	•30166		55	
85	•30166		57	
86		•30166		8
87		•30166		13

88	*30064	6	
89	*30064	40	
90	*30064	41	
91		*30064	12
92		*30064	33
93	*29961	30	
94		*29961	21
95	*29825	17	
96	*29825	39	
97	*29825	44	
98	*29825	46	
99		*29825	6
100		*29825	17
101		*29825	23
102	*29722	36	
103		*29722	16
104		*29722	22
105		*29620	29
106	*29483	4	
107	*29483	8	
108	*29483	73	
109		*29483	1
110		*29483	28
111		*29278	5
112		*29278	27
113	*29141	42	

0

SELECTION NO: 15
VARIABLES USED IN FUNCTION
15

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.00119

0 DISCRIMINANT FUNCTION COEFFICIENTS
.00226

0 MAHALANOBIS DSQUARE= .47670

0 F(1,111)= 11.86277

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.20459	.00004	.00621
2	37	.20030	.00004	.00613

0 FIRST GROUP SECOND GROUP FIRST GROUP SECOND GROUP

RANK	VALUES	VALUES	ITEM NO.	ITEM NO.
1	•21882		66	
2	•21725		45	
3	•21657		22	
4	•21431		5	
5	•21431		15	
6	•21364		55	
7	•21364		74	
8	•21206		14	
9	•21206		62	
10	•21138		46	
11	•21048		13	
12	•21048		20	
13	•21048		86	
14	•21048		60	
15	•21048		75	
16	•20980		18	
17	•20980		28	
18	•20980		68	
19		•20980		24
20	•20912		33	
21	•20912		38	
22	•20912		63	
23		•20912		14
24	•20822		26	
25	•20822		68	
26		•20822		12
27	•20754		9	
28	•20754		10	
29	•20754		11	
30	•20754		50	
31	•20754		89	
32	•20754		64	
33		•20754		25
34		•20754		34
35	•20687		31	
36		•20687		4
37	•20597		47	
38	•20597		70	
39	•20597		72	
40		•20597		32

41	•20529		1	
42	•20529		3	
43	•20529		23	
44	•20529		29	
45	•20529		30	
46		•20529		37
47	•20461		58	
48		•20461		9
49		•20461		10
50		•20461		36
51	•20371		4	
52	•20371		21	
53	•20371		35	
54	•20371		39	
55	•20371		53	
56	•20371		54	
57	•20371		73	
58		•20371		7
59		•20371		13
60	•20303		16	
61	•20303		27	
62	•20303		41	
63		•20303		27
64		•20303		31
65	•20236		19	
66	•20236		32	
67	•20236		42	
68		•20236		19
69		•20236		21
70		•20236		30
71	•20145		52	
72		•20145		2
73		•20145		8
74		•20145		33
75	•20078		40	
76	•20078		43	
77		•20078		17
78	•20010		34	
79	•20010		37	
80	•20010		44	
81	•20010		71	

82		•20010		26
83	•19920		6	
84	•19920		25	
85	•19920		67	
86		•19852		3
87	•19784		12	
88	•19784		69	
89		•19784		16
90		•19784		20
91	•19694		7	
92	•19694		17	
93	•19694		49	
94	•19627		36	
95		•19627		28
96	•19559		8	
97	•19559		48	
98		•19559		29
99	•19469		2	
100		•19469		23
101		•19469		35
102	•19401		24	
103	•19401		51	
104	•19401		57	
105	•19333		76	
106		•19333		18
107		•19243		5
108		•19243		15
109		•19175		1
110	•19108		61	
111		•19108		11
112		•19017		22
113		•18431		6

SELECTION NO. 16
 VARIABLES USED IN FUNCTION
 16

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .00248

0 DISCRIMINANT FUNCTION COEFFICIENTS
 .00311

O MAHALANOBIS DSQUARE#		.44295			
O F(1,111)g		11.02276			
O POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z	
1	76	.28318	.00004	.00647	
2	37	.27919	.00002	.00487	
O	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP	
RANK	VALUES	VALUES	ITEM NO.	ITEM NO.	
1	.29670		26		
2	.29484		29		
3	.29484		58		
4	.29359		66		
5	.29266		23		
6	.29266		63		
7	.29172		62		
8	.29048		5		
9	.29048		7		
10	.29048		10		
11	.29048		11		
12		.29048		21	
13	.28954		22		
14	.28954		33		
15	.28954		47		
16	.28954		80		
17	.28954		51		
18	.28954		82		
19	.28954		59		
20	.28861		9		
21	.28861		27		
22	.28861		68		
23	.28861		74		
24		.28861		7	
25	.28736		25		
26		.28736		9	
27		.28736		25	
28	.28643		3		
29	.28643		18		
30	.28643		35		
31	.28550		2		
32	.28550		6		
33	.28550		53		
34	.28550		56		

35	•28425		1	
36	•28425		14	
37	•28425		28	
38	•28425		57	
39		•28425		24
40		•28425		36
41	•28332		20	
42	•28332		38	
43	•28332		41	
44	•28332		45	
45	•28332		67	
46	•28332		68	
47		•28332		3
48		•28332		11
49		•28332		29
50	•28238		32	
51	•28238		37	
52	•28238		54	
53	•28238		60	
54	•28238		70	
55		•28238		23
56	•28114		42	
57	•28114		72	
58	•28114		76	
59		•28114		2
60		•28114		13
61	•28020		13	
62	•28020		15	
63	•28020		34	
64	•28020		46	
65		•28020		8
66		•28020		17
67		•28020		19
68		•28020		35
69		•28020		37
70	•27927		8	
71	•27927		21	
72	•27927		31	
73	•27927		71	
74		•27927		22
75	•27802		17	

76	•27802	19	
77	•27802	48	
78	•27802	69	
79	•27802	73	
80	•27802	75	
81			14
82		•27802	30
83		•27802	31
84	•27709	12	
85	•27709	24	
86		•27709	4
87		•27709	5
88		•27709	6
89		•27709	10
90		•27709	12
91		•27709	15
92		•27709	34
93	•27616	36	
94	•27616	44	
95	•27616	55	
96	•27491	64	
97		•27491	18
98		•27491	26
99		•27491	27
100	•27398	40	
101	•27398	49	
102	•27398	61	
103		•27398	16
104		•27398	20
105		•27398	32
106	•27304	16	
107	•27304	39	
108	•27180	4	
109		•27180	33
110		•27086	28
111	•26993	30	
112		•26993	1
113	•26775	43	

0

SELECTION NO: 17

VARIABLES USED IN FUNCTION -

17
 0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .00037
 0 DISCRIMINANT FUNCTION COEFFICIENTS
 .00183

0 MAHALANOBIS DSQUARE= .99711

0 F(1,111)* 24.81294

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.49784	.00009	.00933
2	37	.48586	.00007	.00826

0	RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
	1	.51764		63	
	2	.51709		66	
	3	.51343		23	
	4	.51215		29	
	5	.51160		11	
	6	.51160		22	
	7	.51087		5	
	8	.50849		59	
	9	.50794		74	
	10	.50666		3	
	11	.50666		26	
	12	.50666		50	
	13	.50666		82	
	14	.50538		10	
	15	.50538		15	
	16	.50538		45	
	17	.50538		58	
	18	.50538		60	
	19	.50538		62	
	20	.50483		9	
	21	.50483		14	
	22	.50428		18	
	23	.50355		28	
	24	.50355		33	
	25	.50355		38	
	26	.50355		56	
	27	.50355		65	
	28	.50355		68	

29	•50245		20	
30	•50245		75	
31		•50117		24
32	•50062		1	
33		•50062		7
34		•50062		19
35	•49989		47	
36		•49989		36
37	•49934		7	
38	•49934		27	
39	•49934		35	
40	•49934		53	
41	•49934		64	
42		•49934		4
43		•49934		25
44	•49880		21	
45	•49880		31	
46	•49806		13	
47	•49806		51	
48		•49806		9
49	•49751		72	
50	•49697		32	
51	•49697		65	
52	•49623		2	
53	•49623		34	
54	•49623		67	
55	•49569		25	
56	•49569		46	
57		•49569		34
58	•49514		70	
59		•49514		14
60		•49514		21
61	•49386		19	
62	•49386		54	
63	•49331		16	
64		•49331		2
65		•49331		37
66		•49268		10
67		•49268		12
68	•49203		37	
69	•49203		41	

70	•49203		76	
71		•49203		13
72		•49203		30
73		•49203		32
74	•49148		71	
75	•49075		48	
76		•49075		3
77		•49075		31
78	•49020		6	
79	•49020		12	
80		•48965		8
81	•48892		69	
82		•48837		26
83		•48709		17
84	•48654		73	
85	•48599		49	
86	•48599		57	
87	•48526		30	
88	•48526		39	
89	•48526		42	
90		•48526		35
91	•48471		40	
92		•48471		11
93	•48416		24	
94	•48416		44	
95		•48416		20
96		•48416		33
97	•48343		43	
98		•48343		15
99		•48343		18
100		•48343		23
101		•48343		29
102	•48288		4	
103	•48288		17	
104		•48288		27
105	•48233		61	
106	•48050		8	
107	•48050		36	
108		•48050		16
109		•47739		22
110		•47611		28

111	.47557	5
112	.4/191	1
113	.4/191	6

0
SELECTION NO. 18
VARIABLES USED IN FUNCTION
18

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00001

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00002

0 MAHALANOBIS DSQUARE= .00385

0 F(1,111)= .09579

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.00124	.00000	.00056
2	37	.00121	.00000	.00056

0 RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1		.00281		6
2	.00272		76	
3	.00271		63	
4	.00251		45	
5	.00243		55	
6		.00230		21
7	.00223		51	
8		.00223		11
9	.00223		2	
10		.00219		27
11	.00218		46	
12	.00210		57	
13		.00201		16
14	.00193		39	
15	.00187		61	
16	.00186		36	
17	.00186		28	
18	.00185		7	
19		.00181		36
20	.00179		32	
21	.00175		4	
22	.00170		26	

23	.00170		62	
24	.00159		52	
25	.00158		22	
26	.00158		24	
27	.00152		27	
28	.00152		58	
29	.00150		48	
30		.00150		12
31		.00150		18
32	.00148		74	
33		.00144		4
34		.00142		34
35	.00140		29	
36	.00139		47	
37	.00136		15	
38	.00136		43	
39	.00136		66	
40	.00134		50	
41		.00133		23
42		.00132		29
43		.00131		28
44	.00131		42	
45		.00129		17
46		.00129		5
47		.00127		22
48	.00125		96	
49		.00125		35
50	.00122		13	
51	.00122		31	
52		.00121		19
53	.00117		41	
54	.00114		53	
55	.00114		16	
56	.00113		33	
57	.00110		17	
58		.00110		14
59		.00108		3
60		.00107		13
61		.00107		37
62		.00107		32
63	.00105		30	

64		•00103		9
65	•00101		73	
66	•00100		89	
67	•00100		71	
68	•00100		75	
69		•00098		15
70	•00094		64	
71	•00094		65	
72	•00093		34	
73	•00091		10	
74		•00091		25
75	•00091		68	
76	•00090		69	
77	•00088		1	
78	•00088		38	
79	•00088		60	
80	•00087		49	
81		•00087		24
82	•00085		5	
83	•00085		6	
84		•00085		30
85	•00084		11	
86		•00083		31
87	•00082		8	
88	•00081		20	
89	•00081		23	
90	•00081		37	
91	•00080		19	
92	•00080		25	
93	•00074		21	
94		•00073		8
95	•00067		40	
96	•00066		67	
97	•00066		12	
98	•00066		35	
99	•00065		54	
100		•00063		20
101		•00062		2
102	•00060		72	
103	•00059		18	
104	•00059		70	

105		.00053		33
106	.00052		3	
107	.00051		14	
108	.00049		9	
109		.00049		7
110		.00047		10
111		.00045		26
112	.00042		44	
113		.00039		1

0

SELECTION NO: 19
 VARIABLES USED IN FUNCTION
 19

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00008

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00012

0 MAHALANOBIS DSQUARE .01853

0 F(1,111) .46118

0 POP. NO. SAMPLE SIZE

1	76
2	37

MEAN Z

.01217
.01234

VARIANCE Z

.00000
.00000

STD. DEV. Z

.00129
.00117

0

RANK	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP
	VALUES	VALUES	ITEM NO.	ITEM NO.
1	.00842		59	
2	.00537		48	
3		.00961		12
4	.00997		22	
5	.01044		31	
6	.01044		46	
7		.01044		34
8	.01068		38	
9	.01068		65	
10	.01068		75	
11		.01068		27
12	.01080		30	
13	.01080		43	
14		.01080		14
15	.01103		18	
16	.01118		5	

202

17	□.01115		9	
18	□.01115		11	
19	□.01115		62	
20		□.01115		25
21	□.01127		14	
22	□.01127		41	
23	□.01127		44	
24	□.01127		49	
25	□.01127		50	
26	□.01127		71	
27	□.01139		42	
28	□.01139		70	
29		□.01139		13
30		□.01139		26
31	□.01151		47	
32		□.01151		20
33		□.01151		32
34	□.01163		15	
35	□.01163		66	
36		□.01163		10
37		□.01163		17
38		□.01163		33
39	□.01175		19	
40	□.01175		20	
41	□.01175		63	
42	□.01175		64	
43		□.01175		9
44	□.01186		13	
45	□.01186		39	
46	□.01186		37	
47	□.01186		40	
48		□.01186		4
49	□.01198		4	
50	□.01198		67	
51	□.01198		72	
52		□.01198		5
53		□.01198		7
54	□.01210		23	
55	□.01210		28	
56	□.01210		73	
57		□.01210		1

58		□:01210		24
59	□:01222		17	
60	□:01222		33	
61	□:01222		56	
62	□:01222		60	
63	□:01222		74	
64		□:01222		30
65		□:01222		37
66	□:01234		26	
67	□:01234		68	
68	□:01246		34	
69	□:01246		54	
70		□:01246		2
71	□:01258		6	
72	□:01258		12	
73	□:01258		39	
74		□:01258		31
75	□:01270		16	
76		□:01270		29
77		□:01270		36
78	□:01281		25	
79	□:01281		69	
80		□:01281		19
81		□:01281		22
82	□:01293		36	
83		□:01293		16
84	□:01305		10	
85		□:01305		8
86	□:01317		53	
87	□:01329		2	
88	□:01329		3	
89	□:01329		8	
90	□:01329		27	
91	□:01329		61	
92		□:01329		18
93		□:01329		21
94		□:01329		28
95	□:01341		1	
96	□:01353		21	
97	□:01353		24	
98	□:01353		69	

99		=.01353		3
100		=.01353		16
101	=.01376		29	
102	=.01376		32	
103	=.01376		48	
104		=.01388		35
105	=.01400		52	
106	=.01436		57	
107	=.01436		58	
108	=.01448		51	
109		=.01448		23
110		=.01471		11
111		=.01483		6
112	=.01495		7	
113	=.01531		76	

SELECTION NO: 20
VARIABLES USED IN FUNCTION
20

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.00027

0 DISCRIMINANT FUNCTION COEFFICIENTS

=.00005
0 MAHALANOBIS DSQUARE=.00127

0 F(1,111)=.03148

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	=.00116	.00000	.00031
2	37	=.00118	.00000	.00034

0	FIRST GROUP RANK VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	=.00038		48	
2		=.00038		12
3	=.00049		65	
4		=.00049		34
5	=.00055		38	
6	=.00055		41	
7	=.00055		55	
8	=.00066		22	
9	=.00066		39	
10	=.00071		63	

11		□•00071		36
12	□•00077		37	
13	□•00077		43	
14		□•00077		27
15		□•00077		30
16	□•00082		36	
17	□•00082		50	
18	□•00082		59	
19	□•00082		71	
20		□•00088		14
21	□•00093		14	
22	□•00093		44	
23		□•00093		10
24		□•00093		20
25		□•00093		37
26	□•00099		35	
27	□•00099		70	
28	□•00099		75	
29		□•00099		9
30		□•00099		13
31		□•00099		33
32	□•00104		5	
33	□•00104		11	
34	□•00104		15	
35	□•00104		20	
36	□•00104		31	
37	□•00104		32	
38	□•00104		56	
39		□•00104		4
40	□•00110		9	
41	□•00110		19	
42	□•00110		40	
43	□•00110		46	
44	□•00110		54	
45	□•00110		67	
46	□•00110		72	
47		□•00110		1
48		□•00110		7
49		□•00110		26
50		□•00110		31
51		□•00110		32

52	=.00115	6	
53	=.00115	29	
54	=.00115	42	
55	=.00115	49	
56	=.00115	64	
57	=.00115	66	
58			.2
59			8
60			25
61			29
62	=.00121	12	
63	=.00121	17	
64	=.00121	18	
65	=.00121	23	
66	=.00121	30	
67			17
68	=.00126	26	
69	=.00126	53	
70	=.00126	68	
71	=.00132	21	
72	=.00132	25	
73	=.00132	51	
74	=.00132	52	
75	=.00132	60	
76	=.00132	73	
77	=.00132	74	
78			3
79			24
80	=.00137	12	
81	=.00137	24	
82	=.00137	28	
83	=.00137	62	
84	=.00137	69	
85			6
86			15
87	=.00143	3	
88	=.00143	7	
89	=.00143	16	
90	=.00143	34	
91	=.00148	1	
92	=.00148	13	

93	=.00148		27	
94	=.00148		33	
95	=.00148		47	
96	=.00148		61	
97		=.00148		5
98		=.00148		22
99		=.00148		35
100	=.00154		4	
101	=.00154		8	
102	=.00154		10	
103		=.00154		16
104		=.00154		18
105		=.00154		19
106	=.00159		48	
107		=.00159		23
108		=.00159		28
109	=.00170		58	
110	=.00181		57	
111		=.00181		11
112		=.00187		21
113	=.00198		76	

0

SELECTION NO: 21
 VARIABLES USED IN FUNCTION
 21

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00001

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00000

0 MAHALANOBIS DSQUARE= .00006

0 F(1,111)= .00154

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.00037	.00000	.00007
2	37	.00037	.00000	.00008

0 FIRST GROUP SECOND GROUP

RANK	VALUES	VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	.00060		76	
2		.00058		6
3		.00054		11
4		.00052		21

5	.00052		87	
6	.00052		81	
7	.00050		63	
8	.00050		2	
9	.00049		7	
10		.00048		16
11	.00046		61	
12	.00045		58	
13	.00045		32	
14	.00044		62	
15	.00044		28	
16	.00044		46	
17	.00044		48	
18	.00043		36	
19	.00043		24	
20	.00043		4	
21		.00043		27
22	.00043		39	
23	.00043		45	
24		.00043		23
25	.00043		27	
26		.00043		18
27	.00042		26	
28		.00042		36
29	.00041		55	
30	.00041		29	
31		.00041		28
32	.00041		62	
33		.00041		35
34	.00040		74	
35		.00039		22
36		.00039		19
37		.00039		29
38	.00039		47	
39		.00038		5
40		.00038		4
41		.00038		3
42	.00038		63	
43	.00038		16	
44	.00037		13	
45	.00037		66	

46	.00037		33	
47	.00037		15	
48	.00037		56	
49		.00037		17
50	.00036		42	
51	.00036		69	
52	.00036		1	
53	.00036		10	
54		.00036		15
55	.00036		17	
56	.00036		8	
57	.00035		50	
58	.00035		22	
59	.00035		34	
60	.00035		73	
61	.00035		43	
62		.00034		37
63	.00034		21	
64	.00034		59	
65	.00034		68	
66	.00034		25	
67		.00034		32
68	.00034		60	
69		.00034		34
70		.00033		24
71	.00033		31	
72	.00033		6	
73		.00033		9
74		.00033		13
75	.00033		64	
76		.00033		31
77		.00033		8
78		.00033		12
79	.00033		30	
80	.00033		41	
81	.00032		23	
82		.00032		14
83	.00032		3	
84		.00032		25
85	.00032		71	
86	.00032		12	

87	.00032		49	
88		.00031		30
89	.00031		19	
90	.00031		75	
91	.00031		20	
92	.00031		54	
93		.00031		2
94	.00031		8	
95	.00031		11	
96	.00030		37	
97	.00030		67	
98	.00030		40	
99	.00030		35	
100	.00030		72	
101	.00029		65	
102		.00029		20
103	.00028		38	
104		.00028		7
105	.00028		18	
106	.00028		70	
107		.00028		33
108		.00028		1
109		.00027		10
110	.00027		9	
111		.00027		26
112	.00027		14	
113	.00026		44	

0

SELECTION NO. 22
VARIABLES USED IN FUNCTION
22

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
.00008

0 DISCRIMINANT FUNCTION COEFFICIENTS
=.00025

0 MAHALANOBIS DSQUARE= .13937

0 F(1,111)= 3.46826

0 POP. NO. SAMPLE SIZE

1 76

2 37

MEAN Z

= .03098

= .03224

VARIANCE Z

.00001

.00001

STD. DEV. Z

.00336

.00337

0	RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
	1	0.02407		66	
	2	0.02481		55	
	3	0.02481		74	
	4	0.02505		5	
	5	0.02505		46	
	6	0.02555		45	
	7	0.02579		22	
	8	0.02628		15	
	9	0.02628		62	
	10		0.02677		24
	11		0.02702		14
	12		0.02702		25
	13	0.02727		33	
	14	0.02751		28	
	15	0.02751		56	
	16		0.02751		27
	17	0.02776		14	
	18	0.02776		18	
	19	0.02776		26	
	20	0.02776		68	
	21	0.02800		47	
	22	0.02825		4	
	23	0.02825		20	
	24	0.02825		73	
	25		0.02825		13
	26	0.02849		13	
	27	0.02849		31	
	28	0.02849		60	
	29	0.02874		42	
	30	0.02898		65	
	31		0.02898		4
	32		0.02898		9
	33		0.02898		34
	34	0.02972		30	
	35	0.02972		70	
	36	0.02972		75	
	37		0.02972		17
	38		0.02972		21
	39	0.02997		9	

40	=.02997		10	
41		=.02997		37
42		=.03021		12
43	=.03046		72	
44	=.03070		6	
45	=.03070		40	
46	=.03070		54	
47		=.03070		7
48	=.03095		38	
49	=.03095		41	
50	=.03095		64	
51		=.03095		32
52	=.03120		43	
53	=.03120		50	
54		=.03120		10
55		=.03120		26
56		=.03120		36
57	=.03144		29	
58	=.03144		35	
59	=.03144		69	
60		=.03144		33
61	=.03169		11	
62		=.03169		30
63		=.03169		31
64	=.03193		39	
65	=.03218		3	
66	=.03218		16	
67	=.03218		23	
68	=.03218		57	
69	=.03242		25	
70	=.03242		34	
71		=.03242		8
72	=.03267		1	
73	=.03267		27	
74	=.03267		44	
75	=.03267		49	
76	=.03267		58	
77	=.03292		53	
78		=.03292		20
79		=.03292		28
80		=.03292		29

81	□.03316		32	
82	□.03365		8	
83	□.03365		21	
84	□.03365		37	
85	□.03414		63	
86	□.03414		69	
87		□.03439		2
88		□.03439		19
89	□.03463		12	
90	□.03463		71	
91		□.03463		23
92	□.03488		2	
93	□.03488		19	
94	□.03488		67	
95		□.03513		3
96	□.03537		82	
97	□.03562		48	
98		□.03562		11
99		□.03586		18
100	□.03611		7	
101	□.03611		24	
102		□.03611		1
103		□.03611		15
104		□.03611		16
105		□.03611		38
106	□.03635		17	
107	□.03635		76	
108		□.03635		5
109		□.03635		22
110	□.03660		36	
111	□.03709		51	
112	□.03709		61	
113		□.03127		6

0

SELECTION NO: 23

VARIABLES USED IN FUNCTION

23

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00011

0 DISCRIMINANT FUNCTION COEFFICIENTS

0 POP. NO.		SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	2	76	0.09972	0.00002	0.00392
0	2	37	0.09726	0.00001	0.00331
RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.	
1	0.08582		63		
2		0.08750		37	
3	0.08792		23		
4	0.08834		11		
5	0.08959		19		
6	0.08959		29		
7	0.08959		82		
8	0.09043		59		
9		0.09043		21	
10	0.09127		50		
11	0.09169		2		
12	0.09210		51		
13	0.09252		26		
14	0.09294		3		
15	0.09294		9		
16	0.09294		68		
17	0.09294		67		
18	0.09294		71		
19		0.09294		36	
20	0.09336		88		
21	0.09336		88		
22	0.09336		66		
23	0.09378		10		
24	0.09378		38		
25	0.09378		48		
26		0.09378		7	
27	0.09420		7		
28	0.09420		22		
29	0.09420		34		
30	0.09420		47		
31	0.09420		62		
32		0.09420		19	
33	0.09462		18		

34	□.09462		31	
35	□.09462		33	
36		□.09462		29
37	□.09504		6	
38	□.09504		25	
39		□.09504		9
40		□.09504		15
41	□.09545		1	
42	□.09545		5	
43	□.09545		12	
44	□.09545		37	
45	□.09545		49	
46	□.09545		60	
47	□.09545		64	
48		□.09545		4
49		□.09545		18
50	□.09587		14	
51	□.09587		21	
52	□.09587		27	
53	□.09587		53	
54	□.09587		68	
55		□.09587		3
56		□.09587		28
57	□.09629		20	
58	□.09629		41	
59	□.09629		45	
60	□.09629		56	
61	□.09629		87	
62		□.09629		2
63		□.09629		30
64		□.09629		34
65	□.09671		61	
66	□.09671		72	
67	□.09671		74	
68	□.09671		75	
69		□.09671		11
70		□.09671		13
71		□.09671		26
72	□.09713		28	
73	□.09713		54	
74	□.09713		70	

75		000713	17
76		000713	24
77		000713	35
78	0009755		43
79	0009755		69
80		0009755	10
81	0009797		16
82	0009797		17
83	0009797		32
84		0009797	20
85	0009838		15
86	0009838		24
87		0009838	14
88		0009880	22
89	0009922		55
90		0009922	5
91		0009922	12
92	0009964		13
93	0009964		44
94		0009964	6
95	0010006		39
96		0010006	8
97		0010006	31
98		0010006	32
99		0010006	33
100	0010048		8
101	0010048		46
102		0010048	27
103	0010090		73
104	0010132		30
105	0010132		36
106	0010132		40
107	0010132		42
108		0010132	23
109		0010299	1
110		0010299	28
111		0010341	16
112	0010425		4
113	0011220		76

SELECTION NO. 24
VARIABLES USED IN FUNCTION

24

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00000

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00001

0 MAHALANOBIS DSQUARE# .13122

0 F(1,111) = 3.26537

0 POP. NO. SAMPLE SIZE MEAN Z VARIANCE Z STD. DEV. Z

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.00318	.00001	.00364
2	37	.00200	.00001	.00230

0 FIRST GROUP SECOND GROUP FIRST GROUP SECOND GROUP
VALUES VALUES ITEM NO. ITEM NO.

RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	.01536		46	
2	.01379		55	
3	.01230		4	
4	.01230		63	
5	.01022		81	
6	.00957		52	
7	.00957		74	
8		.00957		6
9	.00834		18	
10	.00834		19	
11		.00834		27
12	.00719		5	
13	.00719		48	
14	.00719		73	
15	.00665		42	
16	.00665		66	
17		.00665		14
18	.00563		2	
19		.00563		24
20	.00515		7	
21	.00515		13	
22	.00469		23	
23	.00469		30	
24	.00469		48	
25	.00426		22	
26	.00426		28	
27	.00426		61	

28	.00426		67	
29	.00426		76	
30		.00426		15
31	.00384		71	
32		.00384		25
33	.00345		11	
34	.00345		56	
35	.00345		62	
36		.00345		18
37	.00307		40	
38	.00272		14	
39	.00272		68	
40		.00272		13
41	.00239		20	
42	.00239		33	
43		.00239		19
44		.00239		35
45	.00209		17	
46	.00209		29	
47		.00209		3
48		.00209		11
49		.00209		12
50	.00180		12	
51	.00180		18	
52		.00180		32
53		.00180		37
54	.00153		24	
55	.00153		59	
56	.00153		60	
57		.00153		22
58		.00153		26
59		.00153		34
60	.00129		47	
61	.00129		70	
62		.00129		5
63		.00129		17
64		.00129		33
65	.00106		31	
66	.00106		88	
67	.00106		75	
68		.00106		2

69		•00106		4
70		•00106		31
71	•00086		3	
72	•00086		37	
73	•00086		39	
74	•00086		50	
75		•00086		9
76	•00068		21	
77	•00068		26	
78		•00068		29
79	•00052		34	
80	•00052		36	
81	•00052		54	
82	•00052		72	
83		•00052		8
84	•00038		43	
85	•00038		69	
86		•00038		10
87	•00027		1	
88	•00027		25	
89	•00027		35	
90	•00027		44	
91	•00027		49	
92	•00027		53	
93		•00027		21
94		•00027		36
95	•00017		27	
96	•00017		41	
97	•00017		65	
98		•00017		26
99	•00010		8	
100	•00010		16	
101	•00004		6	
102	•00004		10	
103	•00004		38	
104	•00004		64	
105	•00001		32	
106	•00001		57	
107		•00001		1
108		•00001		7
109		•00001		23

110		•00001	30
111	•00000		9
112		•00000	16
113		•00000	20

SELECTION NO: 25
VARIABLES USED IN FUNCTION

1 2
O INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

•49903 •49901
•49901 •49903

O DISCRIMINANT FUNCTION COEFFICIENTS
•00002 •00002

O MAHALANOBIS DSQUARE •00762

O F(2,110) •09398

O POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	•00012	•00000	•00084
2	37	•00005	•00000	•00068

O	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
---	-----------------------	------------------------	-------------------------	--------------------------

1	•00186		46	
2	•00176		89	
3	•00167		4	
4	•00147		74	
5	•00137		15	
6		•00137		27
7	•00127		5	
8	•00127		45	
9	•00127		73	
10	•00122		42	
11	•00122		66	
12		•00122		14
13		•00113		24
14	•00108		13	
15	•00103		30	
16	•00098		22	
17	•00098		28	
18	•00098		76	
19		•00093		25
20	•00088		56	

21	•00088		62	
22	•00083		40	
23	•00078		14	
24	•00078		68	
25		•00078		13
26	•00073		20	
27	•00073		33	
28		•00069		12
29	•00064		18	
30		•00064		32
31	•00059		60	
32		•00059		28
33		•00059		34
34	•00054		47	
35	•00054		70	
36		•00054		17
37		•00054		33
38	•00049		31	
39	•00049		75	
40		•00049		4
41		•00049		31
42	•00044		39	
43		•00044		9
44	•00039		26	
45	•00034		84	
46	•00034		72	
47		•00034		8
48	•00029		43	
49		•00029		10
50	•00024		44	
51	•00020		41	
52	•00020		65	
53		•00020		26
54	•00015		8	
55	•00015		16	
56	•00010		6	
57	•00010		10	
58	•00010		64	
59		•00005		23
60		•00005		30
61	•00000		9	

62		•00000		16
63		•00000		20
64	□.00005		32	
65	□.00005		57	
66		□.00005		1
67		□.00005		7
68	□.00010		38	
69	□.00020		27	
70	□.00024		1	
71	□.00024		25	
72	□.00024		35	
73	□.00024		49	
74	□.00024		53	
75		□.00024		21
76		□.00024		36
77	□.00029		69	
78	□.00034		34	
79	□.00034		36	
80	□.00039		21	
81		□.00039		29
82	□.00044		3	
83	□.00044		37	
84	□.00044		50	
85	□.00049		58	
86		□.00049		2
87		□.00054		5
88	□.00059		24	
89	□.00059		59	
90		□.00059		22
91	□.00064		12	
92		□.00064		37
93	□.00069		17	
94	□.00069		29	
95		□.00069		3
96		□.00069		11
97		□.00073		19
98		□.00073		35
99	□.00088		11	
100		□.00088		18
101	□.00093		71	
102	□.00098		61	

103	=.00098		67	
104		=.00098		15
105	=.00103		23	
106	=.00103		48	
107	=.00108		7	
108	=.00113		2	
109	=.00137		19	
110	=.00147		52	
111		=.00147		6
112	=.00152		51	
113	=.00167		63	

SELECTION NO: 26
VARIABLES USED IN FUNCTION:

1 2 24
0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .49902 .49901 .00000
 .49901 .49903 =.00000
 .00000 =.00000 .00000

0 DISCRIMINANT FUNCTION COEFFICIENTS
 =.00002 =.00001 .00001

0 MAHALANOBIS DSQUARE = .13168

0 F(3,109) = 1.07262

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.00107	.00001	.00369
2	37	=.00012	.00001	.00229

RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	.01350		46	
2	.01192		55	
3	.01043		4	
4	.00970		63	
5	.00769		74	
6	.00768		51	
7	.00705		52	
8		.00705		6
9	.00644		15	
10		.00644		27
11	.00585		19	
12	.00529		5	

13	.00529		45	
14	.00529		73	
15	.00474		42	
16	.00474		66	
17		.00474		14
18		.00371		24
19	.00322		13	
20	.00322		2	
21	.00276		30	
22	.00275		7	
23	.00232		22	
24	.00232		28	
25	.00232		76	
26	.00231		23	
27	.00231		48	
28		.00190		25
29	.00189		61	
30	.00189		67	
31		.00189		15
32	.00149		56	
33	.00149		62	
34	.00149		71	
35	.00112		40	
36	.00111		11	
37		.00111		18
38	.00076		14	
39	.00076		68	
40		.00076		13
41	.00042		20	
42	.00042		33	
43		.00010		12
44		.00010		19
45		.00010		35
46	.00019		18	
47		.00019		32
48	.00019		17	
49	.00019		29	
50		.00019		3
51		.00019		11
52	.00046		60	
53		.00046		28

54		000046		34
55	000047		12	
56		000047		37
57	000072		47	
58	000072		70	
59		000072		17
60		000072		33
61	000072		24	
62	000072		59	
63		000072		22
64	000095		31	
65	000095		78	
66		000095		4
67		000095		31
68		000095		5
69	000116		39	
70		000116		9
71	000116		58	
72		000116		2
73	000135		26	
74	000135		3	
75	000135		37	
76	000135		50	
77	000152		84	
78	000152		72	
79		000152		8
80	000152		21	
81		000152		29
82	000167		43	
83		000167		10
84	000167		34	
85	000167		36	
86	000179		44	
87	000179		69	
88	000190		41	
89	000190		65	
90		000190		26
91	000190		1	
92	000190		28	
93	000190		35	
94	000190		49	

95	=.00190		53	
96		=.00190		21
97		=.00190		36
98	=.00198		8	
99	=.00198		16	
100	=.00198		27	
101	=.00205		6	
102	=.00205		10	
103	=.00205		64	
104		=.00209		23
105		=.00209		30
106	=.00209		38	
107	=.00211		9	
108		=.00211		16
109		=.00211		20
110	=.00211		32	
111	=.00211		57	
112		=.00211		1
113		=.00211		7

0

SELECTION NO: 27
 VARIABLES USED IN FUNCTION
 6 7

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .19186 .11299 =.08034
 .11299 .18185 =.04798
 =.08034 =.04798 .10243
 0 DISCRIMINANT FUNCTION COEFFICIENTS
 =.00007 .00902 =.00607

0 MAHALANOBIS DSQUARE = .13800
 0 F(3,109) = 1.12407

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.00177	.00001	.00350
2	37	.00053	.00001	.00301

RANK	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP
	VALUES	VALUES	ITEM NO.	ITEM NO.
1	.01104		17	
2	.00987		13	
3	.00894		62	
4	.00836		30	

5		•00745	12
6		•00740	5
7	•00740		47
8	•00711		9
9	•00682		44
10	•00655		22
11		•00626	32
12	•00621		19
13	•00564		85
14	•00560		11
15	•00532		75
16	•00532		50
17	•00504		14
18	•00499		18
19	•00498		10
20		•00470	19
21		•00439	16
22	•00413		60
23	•00410		4
24	•00381		45
25	•00380		15
26	•00378		70
27	•00353		15
28	•00352		28
29	•00351		46
30	•00348		1
31		•00348	25
32	•00320		63
33	•00317		42
34		•00317	21
35		•00316	22
36	•00291		31
37	•00288		33
38		•00261	31
39		•00258	1
40	•00256		12
41	•00255		58
42	•00231		20
43	•00230		66
44	•00228		73
45		•00226	35

46	.00201		64	
47		.00196		3
48	.00195		23	
49	.00194		26	
50	.00164		8	
51	.00138		74	
52	.00136		27	
53	.00136		71	
54		.00111		33
55	.00110		38	
56		.00110		14
57		.00107		2
58		.00106		17
59	.00106		34	
60	.00080		68	
61	.00079		21	
62	.00077		72	
63		.00077		24
64	.00077		53	
65	.00045		35	
66	.00019		39	
67	.00019		40	
68		.00014		18
69		.00012		29
70		.00012		37
71	.00014		59	
72	.00015		82	
73	.00016		67	
74	.00044		16	
75	.00075		36	
76	.00075		61	
77		.00102		4
78	.00104		56	
79		.00105		28
80	.00106		41	
81		.00106		36
82	.00109		57	
83		.00132		34
84		.00134		10
85	.00137		54	
86		.00137		23

87		□.00165		27
88	□.00166		48	
89	□.00166		49	
90	□.00166		76	
91	□.00167		68	
92		□.00169		7
93	□.00194		43	
94		□.00199		6
95		□.00200		15
96		□.00227		20
97	□.00229		51	
98		□.00229		11
99		□.00255		8
100	□.00257		3	
101	□.00259		7	
102	□.00259		29	
103	□.00262		25	
104		□.00286		26
105	□.00288		2	
106	□.00290		6	
107	□.00319		24	
108		□.00347		30
109	□.00348		69	
110		□.00351		9
111		□.00377		13
112	□.00440		37	
113	□.00529		32	

0

SELECTION NO: 28
VARIABLES USED IN FUNCTION

0 INVERSE OF SUM OF PRODUCTS OF DEV FROM MEANS

□.03421 □.01188
□.01188 □.02779

0 DISCRIMINANT FUNCTION COEFFICIENTS

□.00714 □.00027

0 MAHALANOBIS DSQUARES .18518

0 F(2,110) 2.32038

0 POP NO: SAMPLE SIZE

1

76

MEAN Z
□.00824

VARIANCE Z
□.00002

STD DEV Z
□.00407

0	2	37	000994	00001	00354
RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.	
1	0.00033		13		
2	0.00035		30		
3	0.00118		4		
4	0.00118		55		
5	0.00162		64		
6		0.00167		32	
7	0.00186		15		
8	0.00307		31		
9	0.00326		62		
10	0.00335		14		
11	0.00337		18		
12	0.00337		47		
13	0.00365		11		
14	0.00381		75		
15		0.00384		26	
16	0.00392		22		
17	0.00409		46		
18		0.00409		12	
19	0.00456		28		
20	0.00477		5		
21		0.00477		34	
22	0.00483		44		
23	0.00508		43		
24	0.00511		60		
25		0.00519		4	
26	0.00535		40		
27		0.00535		14	
28	0.00554		10		
29	0.00577		34		
30	0.00577		49		
31		0.00577		19	
32	0.00590		68		
33		0.00590		33	
34		0.00615		25	
35	0.00623		33		
36	0.00623		45		
37	0.00626		38		
38	0.00645		21		

39	□.00645		23	
40	□.00651		16	
41	□.00651		63	
42	□.00664		19	
43	□.00678		17	
44	□.00697		66	
45	□.00717		9	
46		□.00738		31
47	□.00758		73	
48		□.00760		24
49		□.00760		28
50	□.00785		12	
51	□.00788		61	
52	□.00837		42	
53	□.00887		74	
54	□.00906		35	
55	□.00928		48	
56		□.00928		18
57	□.00936		2	
58	□.00944		20	
59		□.00944		1
60		□.00958		13
61		□.00974		21
62	□.00977		54	
63	□.01002		50	
64	□.01002		76	
65		□.01008		5
66	□.01021		71	
67	□.01024		1	
68	□.01074		3	
69		□.01082		17
70	□.01109		6	
71	□.01117		26	
72	□.01145		62	
73		□.01145		20
74	□.01148		67	
75		□.01156		16
76		□.01164		22
77		□.01172		27
78	□.01180		70	
79		□.01186		9

80		=01227	2
81		=01230	37
82		=01235	10
83	=01244		69
84		=01252	35
85	=01255		65
86	=01290		27
87		=01290	15
88	=01293		24
89	=01296		53
90	=01296		72
91		=01299	11
92	=01301		57
93	=01304		56
94	=01304		59
95		=01304	30
96		=01310	8
97	=01318		37
98	=01320		39
99	=01320		41
100	=01323		8
101	=01365		51
102		=01365	3
103		=01370	6
104		=01370	36
105	=01373		58
106		=01373	23
107	=01375		36
108	=01439		7
109	=01441		29
110	=01444		25
111		=01447	29
112	=01450		32
113		=01452	7

SELECTION NO. 29
 VARIABLES USED IN FUNCTION
 10 11 12
 0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS.
 .00159 .00007 .00048

	.00007	.00140	.00076	
	.00048	.00076	.00218	
C DISCRIMINANT FUNCTION COEFFICIENTS				
	.00230	.00176	.00052	
C MAHALANOBIS DSQUARE= .88721				
C F(3,109) = 7.22677				
C POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.41064	.00008	.00882
2	37	.40865	.00007	.00814
0	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP
RANK	VALUES	VALUES	ITEM NO.	ITEM NO.
1	.43276		29	
2	.43187		63	
3	.42997		23	
4	.42942		28	
5	.42939		66	
6	.42828		60	
7	.42794		3	
8		.42779		19
9	.42778		11	
10	.42774		18	
11	.42762		74	
12	.42734		82	
13	.42624		68	
14	.42622		5	
15	.42531		50	
16	.42502		22	
17	.42468		9	
18	.42408		64	
19	.42398		34	
20	.42346		53	
21		.42308		4
22	.42292		27	
23	.42275		75	
24	.42253		56	
25	.42212		72	
26	.42204		32	
27	.42202		14	
28	.42198		59	
29	.42191		31	
30	.42122		58	

31	•42122	10	
32		•42076	24
33	•42020	21	
34	•41984	51	
35	•41896	2	
36	•41895	7	
37	•41864	33	
38	•41822	18	
39	•41799	16	
40	•41796	45	
41		•41782	32
42	•41770	20	
43	•41763	1	
44	•41759	62	
45	•41729	38	
46		•41682	7
47	•41663	65	
48		•41645	36
49	•41607	67	
50	•41589	48	
51	•41519	26	
52	•41508	76	
53		•41487	14
54	•41479	13	
55		•41426	37
56	•41417	25	
57		•41415	25
58	•41405	47	
59		•41366	31
60	•41276	55	
61		•41274	9
62		•41263	2
63		•41234	10
64		•41222	13
65	•41173	49	
66	•41169	46	
67		•41112	12
68		•41110	26
69	•41102	12	
70		•41102	3
71	•41060	24	

72		•41047		30
73	•40917		37	
74	•40898		35	
75		•40891		20
76	•40890		69	
77	•40880		40	
78	•40879		70	
79	•40857		19	
80	•40808		54	
81		•40805		16
82	•40776		43	
83	•40775		39	
84		•40739		34
85	•40661		30	
86		•40650		29
87		•40643		8
88	•40613		4	
89	•40585		57	
90		•40585		21
91	•40551		73	
92		•40547		18
93		•40547		35
94	•40542		6	
95	•40496		61	
96		•40473		17
97		•40428		27
98	•40419		42	
99		•40342		23
100		•40308		33
101	•40282		44	
102	•40280		41	
103	•40240		36	
104	•40196		71	
105		•40183		11
106		•40177		15
107	•40122		8	
108		•40034		28
109	•39878		17	
110		•39597		1
111		•39401		22
112		•39305		5

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113
0
SELECTION NO: 30
VARIABLES USED IN FUNCTION
10 11 12 13
0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
    .04388      .04264      .04200      =.04269
    .04264      .04426      .04201      =.04298
    .04200      .04201      .04485      =.04288
    =.04269      =.04298      =.04288      .04309
0 DISCRIMINANT FUNCTION COEFFICIENTS
    .00112      .00058      =.00066      .00119
0 MAHALANOBIS DSQUARES      .89090
0 F( 4,108) = 5.39270
0 POP. NO.      SAMPLE SIZE      MEAN Z      VARIANCE Z      STD. DEV. Z
    1      76      .41850      .00008      .00886
    2      37      .41048      .00007      .00817
0
RANK      FIRST GROUP      SECOND GROUP      FIRST GROUP      SECOND GROUP
VALUES      VALUES      ITEM NO.      ITEM NO.
1      .43470      .29
2      .43380      63
3      .43190      23
4      .43134      28
5      .43130      66
6      .43019      60
7      .42986      13
      .42970      19
9      .42969      11
10      .42964      15
11      .42953      74
12      .42927      82
13      .42815      68
14      .42812      5
15      .42719      80
16      .42689      22
17      .42656      9
18      .42597      64
19      .42587      34
20      .42535      53
21      .42497
4

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63		•41417	10
64		•41406	13
65	•41356		49
66	•41351		46
67		•41294	26
68		•41292	12
69	•41287		12
70		•41287	3
71	•41243		24
72		•41231	30
73	•41099		37
74	•41081		35
75	•41074		69
76		•41072	20
77	•41063		40
78	•41061		70
79	•41040		19
80	•40991		64
81		•40986	16
82	•40957		43
83	•40956		39
84		•40921	34
85	•40841		30
86		•40831	29
87		•40825	8
88	•40794		4
89	•40769		57
90		•40769	21
91	•40732		73
92		•40730	18
93		•40730	35
94	•40725		6
95	•40679		61
96		•40653	17
97		•40607	27
98	•40599		42
99		•40524	23
100		•40488	33
101	•40462		44
102	•40459		41
103	•40418		36

104	.40375		71	
105		.40366		11
106		.40358		15
107	.40302		8	
108		.40214		28
109	.40057		17	
110		.39773		1
111		.39579		22
112		.39481		5
113		.39209		6

0

SELECTION NO. 31
VARIABLES USED IN FUNCTION

14 15 16

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00237	-.00006	-.00102
-.00006	.00133	-.00059
-.00102	-.00059	.00316

0 DISCRIMINANT FUNCTION COEFFICIENTS

.00265	.00166	.00116
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0 MAHALANOBIS DSQUARE= 1.02275

0 F(3,109)= 8.33086

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.49644	.00009	.00943
2	37	.48723	.00007	.00847

RANK	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP
	VALUES	VALUES	ITEM NO.	ITEM NO.
1	.51864		63	
2	.51422		23	
3	.51288		66	
4	.51136		11	
5	.51133		29	
6	.50812		22	
7	.50760		5	
8	.50758		52	
9	.50757		59	
10	.50739		13	
11	.50519		60	
12	.50492		80	
13	.50455		18	

14	•50455	74	
15	•50296	38	
16			19
17	•50282	14	
18	•50277	75	
19	•50271	9	
20	•50262	10	
21	•50239	68	
22	•50208	58	
23	•50197	18	
24	•50195	28	
25	•50179	45	
26	•50130	64	
27	•50106	56	
28	•50094	26	
29	•50056	65	
30			4
31	•50031	62	
32	•50024	20	
33	•50010	21	
34	•49999	33	
35	•49942	1	
36			36
37	•49872	31	
38			24
39	•49839	81	
40			7
41	•49825	7	
42	•49793	53	
43	•49779	34	
44	•49748	35	
45	•49737	2	
46	•49674	27	
47	•49656	32	
48	•49644	67	
49	•49611	72	
50	•49580	47	
51	•49564	13	
52	•49542	16	
53			25
54			34

55		•49479		9
56	•49459		55	
57	•49414		19	
58	•49395		76	
59	•49345		28	
60		•49303		14
61	•49260		48	
62	•49233		70	
63		•49201		10
64		•49199		2
65		•49184		32
66	•49180		46	
67		•49149		30
68	•49146		54	
69	•49126		12	
70	•49109		71	
71		•49102		37
72	•49066		37	
73		•49016		12
74		•49005		21
75		•48934		31
76		•48914		23
77	•48896		69	
78		•48879		3
79	•48867		41	
80		•48866		26
81		•48713		8
82	•48678		49	
83	•48666		6	
84	•48483		43	
85	•48453		30	
86		•48447		18
87	•48431		61	
88	•48419		24	
89		•48400		35
90		•48400		20
91		•48399		17
92		•48383		15
93	•48351		40	
94	•48347		39	
95		•48330		11

96		•48320		33
97	•48316		57	
98	•48268		73	
99	•48197		44	
100	•48035		4	
101	•48034		17	
102		•48031		23
103	•48020		42	
104		•47974		29
105		•47943		27
106		•47870		16
107	•47835		36	
108	•47716		8	
109		•47503		22
110		•47452		28
111		•47243		5
112		•47085		1
113		•47069		6

0

SELECTION NO. 32
 VARIABLES USED IN FUNCTION
 14 15 16 17

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

•01972	•01737	•01617	•01763
•01737	•01883	•01667	•01770
•01617	•01667	•02018	•01746
•01763	•01770	•01746	•01790

0 DISCRIMINANT FUNCTION COEFFICIENTS

•00115	•00015	•00032	•00153
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0 MAHALANOBIS SQUARES 1.03718

0 F(4,108) 6.27816

POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	•50362	•00009	•00955
2	37	•49428	•00007	•00855

RANK	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP
	VALUES	VALUES	ITEM NO.	ITEM NO.
1	•52609		63	
2	•52163		23	
3	•52046		66	
4	•51888		11	

5	•51873		29	
6	•51546		22	
7	•51494		5	
8	•51490		52	
9	•51489		59	
10	•51468		3	
11	•51244		60	
12	•51222		50	
13	•51184		74	
14	•51178		15	
15	•51010		75	
16		•51009		19
17	•51006		14	
18	•51003		38	
19	•50998		9	
20	•50990		10	
21	•50962		68	
22	•50925		58	
23	•50922		18	
24	•50918		28	
25	•50901		45	
26	•50844		64	
27	•50842		26	
28	•50829		56	
29	•50781		69	
30		•50771		4
31	•50760		20	
32	•50744		62	
33	•50727		21	
34	•50709		33	
35	•50677		1	
36		•50612		36
37	•50587		31	
38		•50570		24
39	•50564		7	
40	•50562		51	
41		•50553		7
42	•50513		53	
43	•50479		34	
44	•50468		38	
45	•50456		2	

46	•50395	27	
47	•50372	32	
48	•50360	67	
49	•50340	72	
50	•50302	47	
51	•50277	13	
52		•50255	25
53	•50249	16	
54		•50206	34
55		•50197	9
56	•50169	55	
57	•50123	19	
58	•50106	76	
59	•50077	25	
60		•50012	14
61	•49967	48	
62	•49945	70	
63		•49924	2
64		•49892	10
65	•49890	46	
66		•49888	32
67	•49858	84	
68		•49856	30
69	•49832	12	
70	•49816	71	
71		•49811	37
72	•49761	37	
73		•49722	21
74		•49722	12
75		•49639	31
76		•49638	13
77	•49600	69	
78		•49588	3
79	•49576	41	
80		•49568	26
81		•49434	8
82	•49392	49	
83	•49375	6	
84	•49155	43	
85		•49144	18
86	•49132	30	

87	.49127		61	
88	.49118		24	
89		.49102		.35
90		.49101		17
91		.49097		20
92		.49081		15
93	.49047		40	
94	.49043		39	
95	.49036		87	
96		.49034		11
97		.49029		33
98	.48983		73	
99	.48894		44	
100	.48746		17	
101	.48742		4	
102		.48732		.23
103	.48720		42	
104		.48659		.29
105		.48637		.27
106		.48562		16
107	.48529		36	
108	.48411		8	
109		.48195		.22
110		.48137		.28
111		.47932		.8
112		.47765		1
113		.47755		.6

0

SELECTION NO. 33
VARIABLES USED IN FUNCTION
18 19 20

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS
 .00001 .00001 .00000
 .00001 .00018 .00023
 .00000 .00023 .00056

0 DISCRIMINANT FUNCTION COEFFICIENTS
 .00003 .00023 .00021

0 MAHALANOBIS DSQUARE= .03649

0 F(3,109)= .29720

0 POP. NO. SAMPLE SIZE MEAN Z VARIANCE Z STD. DEV. Z

0		76	001658	000000	000185
1		37	001691	000000	000143
RANK	FIRST GROUP	VALUES	SECOND GROUP	FIRST GROUP	SECOND GROUP
			VALUES	ITEM NO.	ITEM NO.
1		00993		55	
2		01203		46	
3		01223		45	
4		01309		62	
5			01374		27
6		01380		22	
7		01380		31	
8		01385		47	
9		01396		4	
10		01411		30	
11			01427		21
12			01431		12
13		01465		28	
14		01480		13	
15		01482		75	
16			01492		5
17		01503		42	
18		01514		63	
19			01522		25
20			01530		14
21			01530		17
22		01530		18	
23		01531		43	
24		01541		66	
25		01551		49	
26			01560		34
27		01562		33	
28		01568		74	
29		01575		8	
30		01577		11	
31		01577		26	
32		01582		15	
33			01586		32
34		01603		50	
35			01605		13
36		01612		9	
37			01615		4

38	=.01622		73	
39	=.01629		2	
40	=.01630		64	
41		=.01640		19
42		=.01645		24
43	=.01646		61	
44		=.01647		16
45		=.01653		22
46	=.01658		71	
47	=.01661		34	
48		=.01664		26
49	=.01667		60	
50	=.01671		38	
51	=.01672		16	
52	=.01672		17	
53	=.01673		19	
54		=.01680		9
55	=.01682		57	
56	=.01683		65	
57	=.01683		70	
58		=.01684		18
59		=.01692		28
60	=.01693		20	
61	=.01698		14	
62	=.01697		23	
63	=.01699		76	
64	=.01701		27	
65	=.01705		68	
66	=.01710		44	
67	=.01712		86	
68	=.01718		40	
69		=.01720		20
70		=.01729		11
71	=.01733		10	
72	=.01736		41	
73		=.01738		33
74	=.01741		67	
75		=.01748		29
76	=.01752		72	
77	=.01752		48	
78	=.01762		38	

79		-.01765		15
80		-.01768		10
81		-.01770		7
82	-.01780		24	
83		-.01784		37
84	-.01791		25	
85	-.01794		8	
86	-.01802		6	
87		-.01807		1
88	-.01812		12	
89		-.01817		2
90	-.01818		39	
91	-.01819		58	
92	-.01822		37	
93	-.01825		53	
94		-.01827		31
95	-.01827		1	
96		-.01828		6
97	-.01834		84	
98	-.01834		36	
99		-.01839		36
100		-.01852		39
101	-.01875		51	
102		-.01881		3
103		-.01883		30
104	-.01884		13	
105	-.01888		82	
106	-.01889		69	
107		-.01912		8
108		-.01915		23
109	-.01918		32	
110	-.01937		21	
111	-.01939		29	
112	-.01951		89	
113	-.01986		7	

0
SELECTION NO. 34
VARIABLES USED IN FUNCTION
18 19 20 21
0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.29211 .29199 .29220 .29209
 .29199 .29166 .29230 .29196
 .29220 .29230 .29173 .29218
 .29209 .29196 .29218 .29207
 0 DISCRIMINANT FUNCTION COEFFICIENTS
 .00016 .00042 .00002 .00019

0 MAHALANOBIS DSQUARE= .03652

0 F(4,108)= .22107

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	.01657	.00000	.00185
2	37	.01689	.00000	.00142

0 RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	.00992		55	
2	.01202		46	
3	.01222		45	
4	.01308		62	
5		.01373		27
6	.01379		22	
7	.01379		31	
8	.01383		47	
9	.01395		4	
10	.01410		30	
11		.01425		21
12		.01430		12
13	.01463		28	
14	.01479		13	
15	.01481		75	
16		.01490		5
17	.01502		42	
18	.01513		63	
19		.01521		25
20		.01528		14
21		.01528		17
22	.01529		18	
23	.01530		43	
24	.01539		66	
25	.01550		49	
26		.01559		34
27	.01560		33	
28	.01567		74	

29	□.01573		5	
30	□.01575		11	
31	□.01575		26	
32	□.01581		15	
33		□.01584		32
34	□.01602		50	
35		□.01604		13
36	□.01610		9	
37		□.01614		4
38	□.01621		73	
39	□.01628		2	
40	□.01629		64	
41		□.01638		19
42		□.01643		24
43	□.01644		61	
44		□.01645		16
45		□.01651		22
46	□.01657		71	
47	□.01660		34	
48		□.01662		26
49	□.01665		60	
50	□.01670		38	
51	□.01670		16	
52	□.01671		17	
53	□.01672		19	
54		□.01678		9
55	□.01681		87	
56	□.01681		70	
57	□.01681		65	
58		□.01683		18
59		□.01691		28
60	□.01692		20	
61	□.01693		14	
62	□.01695		23	
63	□.01697		76	
64	□.01700		27	
65	□.01704		68	
66	□.01708		44	
67	□.01710		56	
68	□.01716		40	
69		□.01719		20

70		=01727		11
71	=01732		10	
72	=01735		41	
73		=01737		33
74	=01739		67	
75		=01747		29
76	=01750		48	
77	=01750		72	
78	=01760		35	
79		=01763		15
80		=01767		10
81		=01768		7
82	=01778		24	
83		=01782		37
84	=01789		25	
85	=01792		8	
86	=01801		6	
87		=01806		1
88	=01810		12	
89		=01815		2
90	=01817		39	
91	=01817		58	
92	=01821		37	
93	=01823		53	
94		=01825		31
95	=01825		1	
96		=01826		6
97	=01832		54	
98	=01832		36	
99		=01838		36
100		=01857		35
101	=01874		51	
102		=01879		3
103		=01882		30
104	=01882		3	
105	=01887		52	
106	=01887		69	
107		=01910		8
108		=01914		23
109	=01917		32	
110	=01935		21	

111	=.01937	29
112	=.01949	59
113	=.01983	7

0

SELECTION NO: 35
VARIABLES USED IN FUNCTION

22 2

0 INVERSE OF SUM OF PRODUCTS OF DEV. FROM MEANS

.00016 .00011
.00011 .00011

0 DISCRIMINANT FUNCTION COEFFICIENTS

=.00065 =.00041

0 MAHALANOBIS DSQUARE= .30533

0 F(2,110)= 3.76486

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	=.12474	.00002	.00485
2	37	=.12749	.00003	.00524

0	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
---	-----------------------	------------------------	-------------------------	--------------------------

RANK	VALUES	VALUES	ITEM NO.	ITEM NO.
1	=.11563		66	
2		=.11564		37
3	=.11809		63	
4	=.11814		22	
5	=.11816		11	
6	=.11823		23	
7		=.11829		21
8	=.11842		26	
9	=.11862		62	
10	=.11866		5	
11	=.11915		29	
12	=.11965		74	
13	=.11996		48	
14	=.11998		89	
15	=.12000		33	
16	=.12004		65	
17	=.12031		47	
18	=.12048		18	
19	=.12056		50	
20		=.12100		25
21	=.12100		9	

253

22	□.12121		31	
23	□.12172		14	
24	□.12172		68	
25	□.12183		10	
26	□.12189		56	
27		□.12199		24
28	□.12203		60	
29		□.12210		9
30	□.12213		55	
31		□.12221		36
32		□.12252		4
33	□.12253		19	
34		□.12255		7
35	□.12262		20	
36	□.12272		28	
37	□.12275		15	
38	□.12279		38	
39	□.12286		35	
40	□.12301		52	
41		□.12303		13
42	□.12318		3	
43		□.12334		34
44		□.12347		14
45	□.12361		46	
46	□.12379		6	
47	□.12407		58	
48	□.12444		64	
49	□.12448		75	
50	□.12459		2	
51	□.12465		34	
52	□.12489		70	
53		□.12489		17
54	□.12520		72	
55	□.12527		41	
56	□.12548		25	
57		□.12555		29
58	□.12559		71	
59	□.12583		67	
60	□.12585		54	
61		□.12592		26
62		□.12599		30

63		□.12602		27
64	□.12613		1	
65	□.12613		49	
66	□.12616		13	
67	□.12648		57	
68	□.12655		27	
69		□.12658		19
70	□.12675		43	
71		□.12675		10
72	□.12679		53	
73	□.12710		37	
74	□.12715		73	
75	□.12717		51	
76	□.12738		48	
77		□.12743		12
78	□.12751		21	
79	□.12805		42	
80	□.12806		12	
81	□.12813		16	
82	□.12827		7	
83		□.12865		2
84		□.12885		20
85		□.12896		3
86		□.12898		32
87	□.12901		30	
88	□.12909		32	
89		□.12910		15
90		□.12927		18
91		□.12946		33
92	□.12964		69	
93		□.12971		31
94	□.12995		39	
95	□.12998		40	
96	□.13026		44	
97		□.13026		11
98		□.13043		8
99	□.13045		4	
100		□.13116		35
101	□.13171		61	
102	□.13205		8	
103	□.13223		17	

104	=.13240		24	
105		=.13305		22
106		=.13346		5
107		=.13380		28
108		=.13384		23
109	=.13577		36	
110		=.13693		1
111		=.13735		16
112		=.13870		6
113	=.14625		76	
0				

SELECTION NO: 36
 VARIABLES USED IN FUNCTION
 22 23 2

0 INVERSE OF SUM OF PRODUCTS OF DEV FROM MEANS
 =1.00387 1.00392 =1.00392
 1.00392 =1.00381 1.00392
 =1.00392 1.00392 =1.00392
 0 DISCRIMINANT FUNCTION COEFFICIENTS
 =.00024 =.00041 =.00000

0 MAHALANOBIS SQUARES =.00286

0 FI (3,109) = 2.46695

0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z
1	76	=.12441	.00002	.00483
2	37	=.12716	.00003	.00822

0 RANK	FIRST GROUP VALUES	SECOND GROUP VALUES	FIRST GROUP ITEM NO.	SECOND GROUP ITEM NO.
1	=.11831		66	
2		=.11834		37
3	=.11780		63	
4	=.11782		22	
5	=.11788		11	
6	=.11792		23	
7		=.11798		21
8	=.11810		26	
9	=.11830		62	
10	=.11833		8	
11	=.11884		29	
12	=.11932		74	
13	=.11963		45	

14	□.11967		59	
15	□.11968		33	
16	□.11972		65	
17	□.11999		47	
18	□.12016		18	
19	□.12025		50	
20		□.12067		25
21	□.12069		9	
22	□.12088		31	
23	□.12139		14	
24	□.12139		68	
25	□.12151		10	
26	□.12156		56	
27		□.12166		24
28	□.12170		60	
29		□.12178		9
30	□.12178		55	
31		□.12189		36
32		□.12219		4
33	□.12222		19	
34		□.12223		7
35	□.12228		20	
36	□.12238		28	
37	□.12241		15	
38	□.12247		38	
39	□.12254		35	
40		□.12270		13
41	□.12271		52	
42	□.12286		3	
43		□.12301		34
44		□.12313		14
45	□.12326		46	
46	□.12346		6	
47	□.12375		58	
48	□.12412		64	
49	□.12414		75	
50	□.12428		2	
51	□.12433		34	
52	□.12455		70	
53		□.12455		17
54	□.12487		72	

55	□.12494		41	
56	□.12515		25	
57		□.12523		29
58	□.12527		71	
59	□.12551		67	
60	□.12552		54	
61		□.12559		26
62		□.12566		30
63		□.12567		27
64	□.12581		1	
65	□.12581		49	
66	□.12581		13	
67	□.12615		57	
68	□.12622		27	
69		□.12626		19
70	□.12641		43	
71		□.12641		10
72	□.12646		53	
73	□.12677		37	
74	□.12681		73	
75	□.12686		51	
76	□.12706		48	
77		□.12709		12
78	□.12718		21	
79	□.12770		42	
80	□.12774		12	
81	□.12779		16	
82	□.12795		7	
83		□.12832		2
84		□.12851		20
85		□.12863		3
86		□.12864		32
87	□.12866		30	
88	□.12875		32	
89		□.12877		15
90		□.12894		18
91		□.12912		33
92	□.12931		69	
93		□.12936		31
94	□.12960		39	
95	□.12963		40	

96	-.12992		44	
97		-.12993		11
98		-.13009		8
99	-.13009		4	
100		-.13083		35
101	-.13138		61	
102	-.13170		8	
103	-.13189		17	
104	-.13206		24	
105		-.13271		22
106		-.13312		5
107		-.13345		28
108		-.13349		23
109	-.13542		36	
110		-.13688		1
111		-.13699		16
112		-.13836		6
113	-.14587		76	

SELECTION NO: 37
 VARIABLES USED IN FUNCTION
 5 6 7 8 10 11 12 13 14 15
 16 17 22 23 24

0 INVERSE OF SLF OF PRODUCTS OF DEV FROM MEANS

1.19091	.48929	-.61136	-.06337	.10355	-.07823	-.09403
.03700	.03452	-.00011	-.01768	-.04836	-.02488	-.00377
-.00000						
.48929	.55270	-.20173	.17003	.03312	-.04950	-.05717
.01946	.05868	.01646	-.02479	-.03041	-.02084	.00094
.00001						
-.61137	-.20173	1.18197	-.04278	-.06243	.03401	.03422
-.01589	-.13212	.13954	-.02401	.05237	.02870	.00565
.00002						
-.06337	.17003	-.04278	.23245	.00319	-.03403	-.03685
.00853	.05133	.00232	.00419	-.02128	-.01666	.00099
.00002						
.10955	.03312	-.06244	.00320	.13204	.09486	.08550
-.10181	-.05482	-.05778	-.04827	.04400	-.00606	-.00054
-.00000						
-.07824	-.04950	.03401	-.03402	.09456	.13173	.12863

-.11442	-.06251	-.06229	-.05633	.06262	.00635	.00051
-.CCCC0						
-.C94C3	-.05717	.03422	-.03685	.08550	.12863	.13981
-.11319	-.06383	-.05369	-.06428	.06560	.00950	.00014
.CCCC0						
.027C1	.01946	-.C1589	.00853	-.10181	-.11442	-.11319
.110C1	.05417	.05688	.05211	-.05690	-.00167	-.00044
.00000						
.C3453	.05868	-.13212	.05132	-.05482	-.06252	-.06384
.C5417	.08538	.0227C	.04968	-.05347	-.00780	.00034
-.CC000						
-.CC011	.01646	.13954	.00231	-.05778	-.06229	-.05369
.C5627	.02269	.08074	.03124	-.04918	.00417	-.00002
.00001						
-.01767	-.02479	-.02401	.00419	-.04827	-.05833	-.06428
.09211	.04968	.03124	.08941	-.04754	-.00435	.00022
.00000						
-.C4836	-.03041	.08236	-.02125	.04400	.06361	.06560
-.05690	-.05347	-.04018	-.04754	.05208	.00475	.00066
-.00000						
-.02488	-.02054	.02870	-.01666	-.00006	.00635	.00950
-.00167	-.00780	.00417	-.00435	.00475	.00361	.00003
.00000						
-.00377	.00094	.00565	.00099	-.00434	.00051	.00014
-.00044	.00034	-.00002	.00022	.00066	.00003	.00033
-.00000						
-.00000	.00001	.00002	.00002	-.00000	-.00000	.00000
.00000	-.00000	.00001	-.00000	-.00000	.00000	-.00000
.00000						
0 DISCRIMINANT FUNCTION COEFFICIENTS						
.05427	.02069	-.03881	-.01975	.00215	.00346	.00257
-.00109	.00134	-.00430	-.00240	.00298	.00066	.00035
.00001						
0 MAHALANOBIS SQUARE= 1.85466						
0 F(15, 97)= 2.68880						
0 POP. NO.	SAMPLE SIZE	MEAN Z	VARIANCE Z	STD. DEV. Z		
1	76	1.03421	.00016	.01848		
2	37	1.01781	.00016	.01881		
0	FIRST GROUP	SECOND GROUP	FIRST GROUP	SECOND GROUP		
RANK	VALUES	VALUES	ITEM NO.	ITEM NO.		
1	1.06124		63			

2	1.05658		23
3	1.05541		75
4	1.05518		18
5		1.05320	19
6	1.05288		8
7	1.05276		66
8	1.05199		15
9	1.05169		11
10	1.05107		29
11	1.04925		76
12	1.04923		51
13	1.04738		13
14	1.04670		10
15	1.04522		82
16	1.04489		22
17	1.04488		7
18	1.04441		14
19	1.04380		1
20	1.04285		26
21	1.04275		9
22	1.04250		47
23	1.04222		16
24	1.04041		45
25	1.04013		58
26	1.03989		74
27	1.03875		64
28	1.03866		60
29		1.03831	9
30		1.03808	24
31	1.03778		4
32	1.03772		55
33	1.03669		3
34		1.03624	7
35	1.03598		30
36	1.03558		27
37	1.03558		34
38	1.03551		25
39	1.03540		68
40	1.03522		2
41	1.03512		62
42	1.03498		38

43	1.03449		33	
44	1.03449		19	
45	1.03410		28	
46		1.03359		12
47	1.03319		32	
48	1.03239		20	
49	1.03175		72	
50	1.03145		68	
51	1.03123		46	
52		1.03093		25
53	1.03072		35	
54	1.03050		70	
55	1.03041		50	
56	1.03016		24	
57	1.02999		67	
58		1.02951		10
59	1.02933		54	
60	1.02881		17	
61	1.02837		21	
62	1.02831		37	
63	1.02753		56	
64	1.02742		12	
65		1.02719		32
66	1.02635		59	
67	1.02424		31	
68	1.02397		48	
69		1.02384		4
70	1.02352		42	
71		1.02341		2
72	1.02334		53	
73	1.02307		44	
74		1.02280		34
75		1.02269		36
76		1.02194		14
77		1.02181		16
78	1.02177		73	
79	1.02132		71	
80	1.01840		36	
81	1.01839		61	
82	1.01807		5	
83		1.01768		6

84	1.01767		49	
85		1.01747		26
86		1.01648		29
87		1.01620		18
88	1.01561		57	
89		1.01505		31
90	1.01502		43	
91	1.01482		40	
92	1.01466		41	
93		1.01455		3
94		1.01409		35
95		1.01328		13
96		1.01218		30
97	1.01192		8	
98		1.01112		17
99		1.01064		21
100		1.00997		11
101		1.00984		20
102		1.00936		8
103	1.00902		69	
104		1.00899		23
105		1.00854		33
106		1.00851		15
107		1.00759		28
108	1.00632		39	
109		1.00313		8
110		1.00289		37
111		1.00098		27
112		99979		22
113		99601		1



~~THESIS~~

D378

L552 Leonard, Dwight J

cop.2 WISC pattern
analysis

DATE	ISSUED TO
3-6-76	John McNeill
3/8	401 Caltb Hall
VER 10	Frank C. Bostin
	92 Bridger V
WAS 1	Reggie Clayton
	38-22107 W. U.
AUG 5	1980/ange J.
	Terri
	63421
JAN 05	

~~THESIS~~

D378
L552
Cop 2