

A STATISTICAL STUDY OF THE RELATIONSHIP OF TAKING PSSC PHYSICS,
CONVENTIONAL PHYSICS, OR NO PHYSICS IN HIGH SCHOOL, TO
THE GRADES OF STUDENTS TAKING PHYSICS 227 AT
MONTANA STATE UNIVERSITY

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ABSTRACT

This study is a statistical analysis of the relationship between the Montana State University Physics 227 grades and three groups: (1) those students who had no high school physics, (2) those students who had a PSSC high school physics course, and (3) those students who had a conventional high school physics course. The purpose of this study was to determine which group, considering its abilities, got the best grades in Physics 227. It was concluded that the Physics 227 students represent a very homogenous group and that the Physics 227 grade performance was not significantly different between the three groups. In light of these conclusions, a comparative evaluation of the PSSC textbook verses the conventional high school physics textbook cannot be made by an analysis of Montana State University Physics 227 grades.

CHAPTER I

THE PROBLEM

This study is a statistical analysis of the relationship between the Montana State University Physics 227 grades earned by students of three different groups: (1) students who have had no high school physics classes, (2) students who took high school physics and used a conventional text as opposed to the third group, (3) students who had high school physics and used the PSSC textbook. The purpose of this analysis is to determine which group, considering its abilities, obtained the best grades in Physics 227, a mechanics course which is the first college physics course taken by any of the students studied. The PSSC physics textbook emphasizes a new teaching method. Rather than giving a wide variety of practical and theoretical topics with emphasis on the applications, as was characteristic of the conventional textbooks, the PSSC textbook stresses logical reasoning and detailed analysis of problems with emphasis on student discovery of relationships in a few selected topics. This study is therefore an attempt to make a comparative evaluation of the two teaching methods as represented by the conventional and PSSC physics textbooks by comparing MSU Physics 227 grades.

CHAPTER II

BACKGROUND OF THE PROBLEM

Recently, especially in the fields of mathematics, physics, chemistry, and biology, the improvement of secondary school textbooks has been a topic of major concern. Mathematics and science textbooks in the past have been characterized by some teachers as dry, uninteresting books full of facts and formulas to be memorized with great difficulty. One of the science courses, physics, has the reputation as being one of the worst offenders and often the most difficult of all the high school subjects (6:103). At the present time, many new textbooks are being published which stress a different educational method. Most of these new books claim to avoid the use of memorization of facts and formulas. Instead, they stress the logical analysis of problems and student discovery of relationships of physical phenomenon through a laboratory oriented approach and deductive reasoning. For example, one recent physics text published by the Silver Burdett Company (4:ii) makes the following statement in its teacher preface:

This idea is then woven into the textbook to show how questions lead to answers and then to questions again in an ever widening circle. Hopefully encouraged from the start to ask questions, the student will begin to shed the intellectual straightjacket of rote learning and return to the uninhibited why? of his youth.

The following quote from Marsh (5:31) expresses the viewpoint of

many people in the field of education: "It is becoming increasingly clear in the minds of those who face the practical problems of improving instruction, that textbooks usually determine the success or failure of any educational method." It is noted that textbooks are not the only determiner of success or failure, but they certainly are among the most important. The logical question follows: How may textbooks be improved? In an attempt to answer this question, the Physical Science Study Committee (PSSC) was established in 1956 (2:365).

Some educators feel that soon high school physics courses may fail to exist. Twenty years ago, over 20 percent of high school seniors took physics. Now, that figure has dropped to only 5 percent and it is still decreasing (1:373). The natural question followed: What can be done to reinstate the importance of physics to our nation's high school seniors? For the most part, groups such as the PSSC focused their attention on construction of improved high school physics textbooks.

In 1956, there were only 12 different physics textbooks in major use, and of these 12, Marsh (5:72) stated that one had over 50 percent of the market. These texts were similar in nature. For instance, one text (3) was divided into the following chapters:

- (1) The Nature of Matter and Energy, (2) Measurement,
- (3) Force, (4) Motion, (5) Work, Power, Energy, Machines,
- (6) Atomic Structure, (7) Radioactivity and Nuclear Energy,
- (8) The Kinetic Theory of Matter, (9) Thermal Expansion,
- (10) Change of State, (11) Heat and Work, (12) Wave Motion

and Sound, (13) Sound and Music, (14) Illumination, (15) Reflection, (16) Refraction, (17) Color, (18) Electrostatics, (19) Direct Current Circuits, (20) Heating and Chemical Effects of Electric Currents, (21) Magnetic Effects of Electric Currents, (22) Electromagnetic Induction, (23) Alternating Current Circuits, (24) Resonance, (25) Vacuum Tube Characteristics, (26) Vacuum Tube Circuits and, (27) Circuit Applications.

These were the topics generally covered in most of the conventional physics courses. Each topic was chosen with the idea that it was important for college preparation. Furthermore, each topic was considered by many educators to be of prime importance to the life of each student whether he went on to college or never studied another high school or college course in his life. The conventional physics was designed to help each individual understand his physical environment and, as a consequence, be able to cope with his environment more effectively (1:372).

A change of face for the physics textbook was in the making. In 1956, over 200 physicists, secondary school teachers of physics, and specialists, working as members of the PSSC (Physical Science Study Committee) put together a new and drastically different physics textbook to be tried in a few pilot schools. In 1957, the PSSC material was tried in 8 schools. The material was revised and tried again in the school year 1958-59 in 250 schools. In 1959-1960, the PSSC texts were tried in 800 schools (5:204). These tests were said to be successful by the PSSC, but it must be remembered that the members of the PSSC were no doubt highly prejudiced in favor of their own textbook. With this in mind, their conclusions

might be questioned.

The PSSC textbook differed from the conventional physics high school text in several ways. When the PSSC developed their text, they felt that the theoretical ideas of science were the most interesting aspects. They also assumed that most high school students felt the same way. To the PSSC, the practical applications such as the radio or refrigerator were of lesser importance (5). In 1947, the National Society for the Study of Education (5:136) stated that in making new editions of physics texts, material is often added but little is dropped. "...it is far better to leave out whole sections ...than to teach so much poorly." For the most part, there are relatively few topics covered in the PSSC text when compared to the conventional text; and each topic is covered in detail.

Brauer (1:366) made a study to compare the PSSC text to the conventional texts. He stated that, "3/4 of the subject matter of conventional high school physics was left out (of the PSSC text)." The following is a partial list of topics which Brauer found missing from the PSSC text but found in conventional texts:

electrical refrigerators	radio	speed of sound
gas refrigerators	television	interference
inclined planes	levers	malleability
surface tension	gears	ductility
specific gravity	pulleys	hardness
reflection of sound	pumps	rigidity
archetectoral accoustics	siphon	viscosity
sympathetic vibrations	resonators	osmosis
Archimede's principle	the ear	gravity
sliding and rolling friction	music	inertia
open and closed pipes	voice	geared wheels
Doppler's principle	phonograph	wheel and axle
hydraulic lift	moments	heat engines
mechanical advantage	cohesion	torque
laws of strings	adhesion	work

Marsh (5:136) stated, "Avowedly aiming at average and better students,...(many members of the PSSC) argued for teaching scientific concepts rather than facts and for selecting a few principles to be studied in depth rather than skimming over a large number of them." The differences between the PSSC text and the conventional texts are therefore summarized by the following generalities: The conventional texts tend to present a large number of ideas and their practical applications in order that the physics students will be better able to cope with their environment. The PSSC text covers a few ideas in depth and attempts to encourage physics students to develop and use their reasoning ability to solve problems of their environment.

According to Marsh (5:216), the Educational Testing Service constructed a new College Entrance Examination for students with a PSSC high school physics background. Marsh stated that "students who used PSSC materials found themselves at no disadvantage in college entrance testing." He did not, however, state how this conclusion was reached or how this comparison was made. As a result, the validity of this comparison is questionable. Marsh also stated the following: "Furthermore, the results of those tests, compared with scores on the Board's traditional physics examinations, might make possible some day at least, a partial evaluation of the PSSC course." Thus, the need for a study to evaluate the PSSC program is indicated. The researcher

has, at present, found no evidence that such an evaluation has been made.

The proposed study's primary value lies in the Physics 227 grade comparison of the three groups of students; those who have had no high school physics, conventional high school physics, or PSSC high school physics. Such a study has deeper implications however. The difference between the conventional texts and the PSSC text lies in educational method. A comparative evaluation of the two types of texts therefore is a comparative evaluation of the teaching methods utilized in the texts. This study might be generalized into the following problem: Is it possible, by investigating college performance, to determine any difference between students taught by (1) stressing logical reasoning and detailed analysis of problems with emphasis on student discovery at the cost of covering a wide variety of topics, and (2) exposure to a wide variety of practical, as well as theoretical topics, with emphasis on the applications of presented relationships to problems?

CHAPTER III

EXPERIMENTAL PROCEDURE

Included in this chapter are the sources of data, the limitations, and the treatment of the data. The general procedure of this study is statistical and the prime reference for statistical methods and tables is Principles and Procedures of Statistics by Robert Steel and James Torrie (7).

I. SOURCES OF DATA

Students who had enrolled in Physics 227 during the Fall and Spring Quarters, 1965, at Montana State University, filled out a brief questionnaire giving their name and their high school physics background as either (1) no high school physics taken or (2) if a high school physics course was taken, was it the PSSC course? They also gave their year in school.

Additional data on each student listed in the above questionnaire was obtained from the MSU Physics Office records. This data included each student's University Computed High School Grade Point Average as explained in Appendix A and also each student's numerical Physics 227 grade.

In addition, computer data IBM cards on the students who had taken Physics 227, Spring Quarter, were obtained from the MSU Testing and Counseling Service. The data on these cards included

the following (8:4):

1. High school physics grade point average, adjusted to a common four-point scale.
2. High school trigonometry, solid geometry, and advanced math courses taken in high school, also adjusted to a common four-point scale.
3. ACE Quantative test scores (American Council on Education Psychological Examination for College Freshmen, 1954), a timed test given to first quarter Freshmen at Montana State University. This test consists of mathematical reasoning, number series, and figure analogies.
4. Algebra I score, a MSU Mathematics Department test.
5. Algebra II score, a MSU Mathematics Department test.
6. Mechanical Comprehension Test, Form CC, by O. Owens and Bennett; a test to measure understanding of physical and mechanical relationships important in engineering, physics, chemistry, mathematics, and mechanics courses.
7. Logical Reasoning Test. This is a "test to apprehend meaningless figures presented for his observation, see the relationships between them, and see the nature of the figure completing each system of relations presented; and by so doing, develop a systematic method of reasoning."
8. The University Computed High School Grade Point Average.

Subject to the limitations, this data is presented in Appendix B.

II. LIMITATIONS

This study concerns only Montana students and Montana State University. No generalization is intended to include students of other states or students of other universities. To include other states or students of other schools would add extra variables to complicate the results and cloud the conclusions and is beyond the scope of this study. This study also relates only to Physics 227 at Montana State University. Physics 227 is a mechanics course; therefore, the study will relate only to the mechanics aspect of physics. Both PSSC and conventional texts cover this topic.

In the school year 1965, there were only 12 students who had taken no high school physics and who met the qualifications to be included in the sample groups. This determined the maximum sample size for one part of the analysis. A larger sample, if this could have been attained, would certainly have led to greater precision in the analysis.

III. TREATMENT OF THE DATA

In obtaining the samples to be studied, certain limitations were imposed by the availability of the data and by the researcher to eliminate extraneous variables. The following are the limitations which apply to the sample of Physics 227 students, Spring Quarter, 1965, as listed in Appendix B:

1. Some students were absent when the questionnaire was handed out. Their number was so small that no follow-up work was done to include them in the sample.
2. Data cards were not available for many of the students due to a changeover of student number systems being conducted at the computer center at the time the samples were taken.
3. Some students dropped Physics 227 rather than completing it. Since a numerical grade could not be objectively assigned by the researcher, these students were not included in the samples taken.
4. The sample includes only students who were third quarter Freshmen. Other more advanced students were not included since these students might have had other physics courses or other additional science courses which would have given them a different background.

A second sample was taken from both Spring and Fall Quarters, 1965. This sample is representative of all students who graduated from high school in 1964 and who took MSU Physics 227 in 1965.

The same qualifications listed on page 10 for the sample as presented in Appendix B also apply here with one additional qualification. It is possible for a student to take Spring Quarter Physics 227, fail the course, and then take it again in the Fall Quarter. Any student in this category was listed in the Spring Quarter group but eliminated from the Fall Quarter group since this would be his second chance at the same physics course.

The students were then split into three groups: (1) those who had no high school physics background, (2) those who had a PSSC high school physics background, and (3) those who had a conventional physics background. The first group contained only 12 students so a sample of 12 from each of the other two groups was randomly selected. These groups with their respective Physics 227 grades and high school GPA are listed in Table II on page 14.

The data as listed in Appendix B was used in a Pearson's r correlation program and by computer, the following information was obtained: (1) the mean for each set of scores, (2) the standard deviation for each set of scores, and (3) the correlation coefficient between each of the scores, taken two at a time. These results are presented in Table I on page 12.

The grouped data as presented in Table II on page 14 has with it the corresponding computed values as explained below. The "A" factor represents the high school grade point average for each student and this factor is paired with the "Y" factor which is

TABLE I

STATISTICAL DATA CALCULATED FROM TEST SCORES
AND GRADES OF PHYSICS 227 STUDENTS

- A. College Physics 227 Grade
- B. High School Physics GPA
- C. High School Trig, Solid Geometry, and Adv. Math GPA
- D. ACE Quantitative
- E. Algebra I
- F. Algebra II
- G. Mechanical Comprehension
- H. Logical Reasoning
- I. High School GPA

Factor	Number of Scores Available	Mean	Standard Deviation
A	73	70.7	12.5
B	49	31.7	6.1
C	36	33.9	6.6
D	72	49.1	9.1
E	72	36.4	6.1
F	70	21.0	4.3
G	72	38.3	8.0
H	73	30.8	3.9
I	64	31.8	6.0

Factor	Correlation Coefficient "r"							
	A							
B	.014	B						
C	.046	.239	C					
D	.118	.176	-.108	D				
E	-.023	*.337	.231	*.507	E			
F	.000	.224	.251	.145	*.522	F		
G	-.061	.198	.190	.072	.131	.019	G	
H	-.143	-.027	-.043	.168	.163	.087	*.239	H
I	.125	*.368	.182	*.269	*.377	*.250	-.127	.056

*significant at the .05 level

the Physics 227 grade. From the paired values, the following was calculated: (1) the mean for each group, (2) the standard deviation for each group, (3) the correlation coefficient between high school GPA and Physics 227 grades for each group, (4) the regression coefficient for each group, and (5) an analysis of variance to test the hypothesis that the Physics 227 grade means for all three groups are equal.

TABLE II

COMPARATIVE STATISTICAL ANALYSIS OF PHYSICS 227 GRADES
AND HIGH SCHOOL GPA FOR STUDENTS WHO HAD CONVENTIONAL,
PSSC, OR NO HIGH SCHOOL PHYSICS

A. High School GPA (times 10)

B. Physics 227 Grade

No High School Physics		PSSC High School Physics		Conventional High School Physics	
<u>A</u>	<u>Y</u>	<u>A</u>	<u>Y</u>	<u>A</u>	<u>Y</u>
20	86	31	80	34	75
27	67	28	73	21	71
37	62	28	77	33	81
30	60	29	68	28	78
35	83	23	58	33	63
25	86	36	79	36	92
20	68	30	70	35	75
21	69	31	68	32	54
20	56	16	73	38	78
35	54	29	77	33	71
14	59	30	83	35	71
28	82	24	47	29	71
Means					
26.0	69.3	27.9	71.1	32.3	73.3
Standard Deviations					
7.2	12.0	5.0	10.1	4.5	9.2
Regression Coefficients "b"					
b = -.023		b = .881		b = .497	
Correlation Coefficients "r"					
r = .00		r = .44		r = .24	

Hypothesis: The average Physics 227 grades of the three groups;
(1) those with no high school physics background,
(2) those with a PSSC physics background, and (3) those
with a conventional physics background are equal.

Source of Variation	df	ss	ms	F
Between Groups	2	96.49	43.3	.39*
Within Groups	33	3642.26	110.4	
Total	35	3738.75		

*not significant

CHAPTER IV

INTERPRETATION OF THE RESULTS

In the results of the correlation program as listed on Table I, page 12, the most striking feature is the lack of strong correlation of the Physics 227 grades to any of the other factors studied. The greatest correlations to the Physics 227 scores are with the high school GPA ($r = .125$) and with the ACE Quantitative scores ($r = .118$). A small negative correlation also resulted with the Logical Reasoning test scores ($r = -.143$). None of these values of r is large enough to be significant at the .05 level. Particular note is taken of the correlation between the Physics 227 grades and the high school physics GPA ($r = .014$), also not significant at the .05 level.

In comparison to the low correlations, the high school physics GPA shows moderate correlation with the Algebra I test ($r = .337$) and with the high school GPA ($r = .368$). The ACE test scores show good correlation with the Algebra I test ($r = .507$). The correlation between Algebra I and Algebra II ($r = .552$) is the strongest. These are significant at the .05 level.

The low correlations with the Physics 227 grades as opposed to the greater correlations among some of the other factors studied would indicate that the Physics 227 students are a rather homogenous group. The low correlations with the Physics 227 scores could be the result of a practice of assigning a wide range of

grades in Physics 227 to students whose abilities are comparatively similar.

As shown on Table I, page 12, the greatest positive correlator with Physics 227 grades was the high school GPA. In Table II, page 14, the high school GPA is shown paired with the respective Physics 227 scores for three groups: (1) those who had no high school physics classes, (2) those who had PSSC high school physics, and (3) those who had conventional high school physics. The conventional group had the highest Physics 227 grade average at 73.3, followed by the PSSC group at 71.1, and the no physics group is last with an average of 69.3. The high school GPA averages, however, are in the same order at 32.3, 27.9, and 26.0 respectively. Hence, the differences in Physics 227 scores might be attributed to the difference in their abilities as expressed by the high school GPA averages.

An analysis of variance as shown on Table II was used to test the following hypothesis: The average Physics 227 grades of the three groups are equal. The F value was not significant; therefore, no difference in performance between the groups is indicated. The standard deviations of the Physics 227 scores are 9.2 for the conventional group, 10.1 for the PSSC group, 12.0 for the no physics group (all from Table II), and 12.5 for the group as a whole as shown on Table I. The greatest spread is between the conventional group and the group as a whole. To test the hypothesis that the

variance of the Physics 227 grades for the conventional group is the same as the variance for the group as a whole, an F value of 1.85 (df = 72,11) was obtained. At the .100 level, the F value is 2.03; thus, the hypothesis is not rejected but it is noted that the values are not too far apart. The greatest spread in standard deviation for the high school GPA is 4.5 for the conventional group and 7.2 for the no physics group. To test the hypothesis that the variances of the high school GPA scores is the same, a F value of 2.56 (df = 11,11) was obtained. The rejection F value at the .100 level is 2.23; hence, this hypothesis is rejected. This indicates that the scores for the conventional group and the no physics group do come from different populations. A similar test between the variances of the high school GPA for the PSSC group and the high school GPA of the no physics group gave an F value of 2.08 (df = 11,11). The rejection value is 2.23 so this difference was not significant by a narrow margin.

The regression coefficients and correlation coefficients are also shown on Table II, page 14. The confidence belt for the no high school physics group correlation ($r = .00$) is $+.55$ to $-.55$. The confidence belt for the PSSC group correlation ($r = .44$) is $+.80$ to $-.15$. These are at the 95 percent level. These values, therefore, do not yield any significant results as the sample size is small.

The conclusions may therefore be summarized as follows:

1. The Physics 227 students are a comparatively homogenous group as shown by the low correlations of the Physics 227 grades to the other factors studied.
2. A significant difference in variance suggests that the conventional group and the no high school physics group are from different populations. No other significant differences were detected.
3. No significant difference in Physics 227 performance could be detected between the conventional, PSSC, or no high school physics groups.

CHAPTER V

SUMMARY

The problem. This study is a statistical analysis of the relationship between the Montana State University Physics 227 grades and three groups: (1) those students who had no high school physics, (2) those students who had a PSSC high school physics course, and (3) those students who had a conventional high school physics course. The purpose of this study was to determine which group, considering its abilities, got the best grades in Physics 227

Background of the problem. Recently, the improvement of high school physics textbooks has been a topic of major concern. The Physical Science Study Committee was created for the expressed purpose of developing a better high school physics textbook. The text which they developed differed from the conventional physics textbooks in many distinguishing ways. The number of topics covered was greatly reduced. The topics which were covered, were covered in much greater detail. Logical reasoning was stressed with emphasis on student discovery in a laboratory oriented approach. With the widespread use of the new PSSC physics text, the question arose: Is the new approach as represented by the PSSC text better than the conventional approach in physics teaching?

Treatment of the problem. High school grade averages, Montana State University entrance test scores, and numerical

physics grades were obtained for students who had taken Physics 227, a mechanics course. These scores were used to find the correlation coefficients between the factors studied. In addition, the Physics 227 students were split into three groups: (1) those who had no high school physics, (2) those who had PSSC high school physics, and (3) those who had conventional physics. The high school GPA was paired with the Physics 227 grades for each student in each group and correlation coefficients, tests of means and variances, and an analysis of variance was used in analyzing the data.

Conclusions. The Physics 227 students constitute a comparatively homogenous group as is shown by the low correlations of Physics 227 grades to the other factors studied. A significant difference in variance suggests that the group which had no high school physics and the group which had conventional high school physics do come from different populations. No other significant differences were detected. No significant difference in Physics 227 performance could be detected between the conventional, PSSC, or group which had no high school physics.

Suggestions for further study. In light of the relatively small number of students taking Physics at Montana State University, a similar research project in a much larger university with its greater sample size, might yield greater precision to the results. Other factors used to correlate with the Physics 227 grades might also be considered. The development of a special test to be used to compare the PSSC and conventional texts might prove to be a more fruitful approach to the problem.

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APPENDIX

APPENDIX A

UNIVERSITY COMPUTED HIGH SCHOOL GRADE POINT AVERAGE

The University Computed High School Grade Point Average which will be referred to as the high school GPA is obtained in the following manner (8:3):

1. A grade average is computed for all English courses taken during the junior and senior year in high school.
2. A grade average is computed for social studies taken during the last two years in high school.
3. A grade average is computed for the semesters of chemistry taken in high school.
4. A grade average is computed for the semesters of physics taken in high school.
5. A grade average is computed for all the commercial courses taken during high school.
6. A grade average is computed for any vocational courses that are taken in high school.
7. A grade average is computed for semesters of language taken in high school.
8. A grade average is computed for the trigonometry, solid geometry, and advanced courses that are taken in high school.

These averages are then averaged to give the total high school grade average as used in this study.

APPENDIX B

HIGH SCHOOL, FRESHMAN ENTERANCE TEST, AND PHYSICS 227 SCORES

<u>Column</u>	<u>Source of Score</u>
A*	Physics 227 grade
B*	High school physics GPA
C*	High school trig and solid geometry GPA
D	ACE Quantative
E	Algebra I
F	Algebra II
G	Mechanical Comprehension
H	Logical Reasoning
I*	High school GPA

*scores multiplied
by 10

Student Number	A	B	C	D	E	F	G	H	I
1	76	35	20	61	36	21	48	35	25
2	69	25	30	53	32	19	34	30	57
3	64	35	40	57	43	26	42	35	36
4	75		30	52	42	17	31	30	35
5	62	30	30	38	28	14		32	30
6	72			33	13		29	29	
7	73	40		49	39	24	45	33	34
8	35	35		38	32	13	42	30	30
9	85	40	40	50	37	18	47	30	32
10	66	25	30	35	33	26	28	31	23
11	32	40	30	58	45	28	51	34	32
12	28	30		45	39	24	36	34	31
13	73	35		42	36	26	38	34	36
14	76			39	33	21	42	28	
15	85	40	40	51	42	25	33	33	34
16	78	25	35	41	44	27	38	33	34
17	70	30	30	50	28	20	41	29	28
18	74	35	30	51	40	23	33	33	29
19	74			74	39	23	43	35	
20	71	20		48	40	20	50	33	26
21	54			37	38	21	16	28	35
22	84	35	30	46	38	12	32	32	34
23	69	40		54	37	22	40	25	36
24	72			53	39	25	38	35	
25	75	35	30	55	36	19	40	34	37
26	79	25	20	44	31	14	30	29	26
27	73	30	30	45	40	27	31	28	29
28	83			67	43	28	43	34	30
29	73	25		61	35	14	29	31	28
30	74	35	40	58	42	22	51	32	34

(cont.)

APPENDIX B (cont.)

Student Number	A	B	C	D	E	F	G	H	I
31	64			49	36	17	28	26	34
32	77	40	40	61	39	18	51	34	39
33	77			46	33	24	41	32	39
34	76			65	40	19	37	31	
35	71			61	43	25	29	32	35
36	76	25	40	44	39	24	38	29	30
37	68	20		42	31	13	48	29	19
38	70	30	35	38	31	17	34	32	33
39	83	35	40	40	37	24	37	29	30
40	81						29	21	
41	75	25	20	40	26	13	45	33	21
42	81	35	40	50	45	24	50	32	33
43	31	35	40	38	34	21	51	26	25
44	76	30	40	36	31	22	51	32	29
45	72	30	40	32	35	19	42	32	33
46	70	25		47	37	23	51	34	27
47	83			50	39	24	38	32	
48	75			71	38	22	40	32	34
49	71	25		45	21	15	34	29	21
50	79			35	33	19	32	32	
51	83	35	35	48	35	19	43	31	31
52	75	40		49	43	28	43	36	38
53	77	25		41	25	14	41	28	28
54	50	30	40	43	42	27	47	35	34
55	75	40	40	41	31	18	40	29	35
56	50	40	30	50	42	17	40	33	33
57	73	30	40	50	37	21	26	29	34
58	88	40	40	48	40	24	42	09	30
59	64	30	30	56	40	22	34	26	32
60	67	20	40	46	34	19	37	35	27
61	68	25	20	56	28	19	33	25	29
62	79			45	33	27	36	28	32
63	63			36	22		26	32	18
64	51	35		53	44	23	50	33	28
65	63			54	38	19	42	34	35
66	86	40	35	53	36	17	50	34	37
67	62			59	44	28	19	33	37
68	87			49	43	28	32	25	40
69	68			62	43	18	25	28	36
70	69	25		58	34	15	40	32	21
71	65			59	43	23	38	32	38
72	83			48	42	25	41	32	
73	82			58	36	19	29	33	38