

A STUDY OF THE DIFFICULTY OF ITEMS IN THE  
ARMY ALPHA INTELLIGENCE TEST AND  
A SUGGESTED REVISION  
OF THE TEST

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CHRISTINE VIOLA BRANNAN, M.S.,  
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Approved for Major Department

H. E. Schramm

Approved for Graduate Council

Edwin Brown

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## CHAPTER I

### HISTORY OF THE ARMY ALPHA INTELLIGENCE TEST

When the United States entered the Great War, suitable criteria for classifying recruits, such as officers could supply only after they had trained the recruits for some time, were much needed. Therefore, psychological tests were prepared by a committee of eminent psychologists from the Council of the American Psychological Association and the psychology committee of the National Research Council, and were administered to the recruits in the several camps by examiners who were enlisted in the psychology section of the Medical Corps and trained in the School of Military Psychology.

The Committee on the Psychological Examination of Recruits, composed of R. M. Yerkes, chairman; W. V. Bingham, secretary; H. H. Goddard, T. H. Haines, L. M. Terman, F. L. Wells, and G. M. Whipple, met at the Training School, Vineland, New Jersey, on the afternoon of May 28, 1917. The committee discussed the relative merits of brief individual tests and longer group tests, and concluded that the group examination would be preferable if a successful one could be prepared, since the longer test would be more reliable than the necessarily brief interview.

Group testing was at that time a new field. Arthur S. Otis, who had been devising a series of group tests, placed his tests at the disposal of the committee. "Four of the ten tests in the original Army scale for group testing were taken from the Otis scale practically without change, and certain

others were shaped in part by suggestions derived from the Otis series."<sup>1</sup>

The committee considered the relative merits and adaptability of various types of tests, and finally selected the following for trial: Test 1, oral directions; test 2, memory for digits; test 3, disarranged sentences; test 4, arithmetical reasoning; test 5, information; test 6, synonym-antonym; test 7, practical judgment; test 8, number series completion; test 9, analogies; test 10, number comparison.

Test 1 was assigned to Whipple, who also rewrote instructions for other tests; tests 2, 5, 8, and 10, to Wells, who had already assembled considerable material on memory for digits and number comparison; tests 3 and 7, to Haines and Goddard; test 4, to Bingham; and tests 6 and 9, to Terman. The entire group made suggestions for and criticised all the tests.

In June, 1000 copies were printed for preliminary trial of the group method before undertaking to prepare methods for individual examining. Yerkes tested 50 inmates of the Massachusetts School for the Feebleminded, Waverley, Massachusetts, and 25 subjects at the Boston Psychopathic Hospital; Wells tested 50 subjects at the Reformatory for Men, Concord, Massachusetts; Haines tested 50 aviation recruits in Ohio; Terman tested 60 high school pupils and 43 prisoners in California; Bingham and Goddard, assisted by N. J. Melville, tested 114 marines at the Philadelphia Navy Yard and 27 men

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<sup>1</sup> Robert M. Yerkes, editor, "Psychological Examining in the United States Army." National Academy of Sciences, Memoirs.



at the Carnegie Institute of Technology; Whipple tested 50 men in the officers' training camp, Fort Benjamin Harrison, Indiana. The California students and prisoners had been tested with the proposed Army test, the Stanford-Binet scale, the Yerkes-Bridges point scale, and the Trabue language tests, and several of the marines were given an abbreviated Binet test.

The scores and correlations for these tests served as a basis for revision and standardization. According to Yerkes,<sup>2</sup>

The correlations which the tests gave were therefore in the main satisfactory. They were high with outside measures of known value; they were high enough with one another to indicate that all were reasonably good tests of general intelligence; at the same time the intercorrelations of the tests were not high enough to suggest that the tests were only repetitive of one another.

Ten forms of the test had been prepared originally. In July, one thousand copies of each of five of these forms, A, B, C, D, and E, with minor modifications suggested by the results of the experiment, were printed.

Group examination a was then given to three thousand soldiers, 759 men in the Brooklyn Fleet, and 372 individuals in institutions for the feeble-minded. The results of the examinations of soldiers were treated by a statistical unit under the direction of Thorndike and reported August 15. After this unofficial trial, it was tried officially, and was found satisfactory except in minor details.

The numerous individual tests which the committee had

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<sup>2</sup> Ibid., p. 305.

meanwhile developed were abandoned in favor of the more convenient group method, and experimentation on a group test for foreigners and illiterates was begun at the various camps. This test is examination Beta. Abbreviations of the Stanford-Binet scale and the Yerkes-Bridges point scale were made for individual testing of men who made unusually low scores on the group tests.

Examination a was given to more than 98,000 men before January, 1918, when it was revised to make examination Alpha. The test was found to differentiate between officers and enlisted men, and between normal and feeble-minded persons. Studies were made of the proportion of zero and perfect scores, correlations with officers' ratings of men, correlations with total scores, time limits of the tests, and methods of scoring and weighting. Scores of more than a thousand California school children were correlated with Stanford-Binet mental age, chronological age, schooling, other tests, and teachers' estimates of intelligence, dependability, social adaptability, and power to give sustained attention.

The tests of memory for digits and number comparison were eliminated, and the other tests revised. Some of the tests were lengthened, and some easier and some more difficult items inserted. The tests were numbered as follows: Test 1, oral directions; test 2, arithmetic reasoning; test 3, practical judgment; test 4, synonym-antonym; test 5, disarranged sentences; test 6, number series completion; test 7, analogies; test 8, information.

Examination Alpha was used immediately and retained

until the close of the war as the group examination for literates. Between April 1 and December 1, 1918, it was given to approximately 1,250,000 men.<sup>3</sup>

From this mass of data, interesting information was obtained concerning the intelligence of the drafted men, and of various occupational groups.<sup>4</sup> These extensive norms probably have contributed in great measure to the continued popularity of this pioneer test.

The Bureau of Educational Measurements of the Kansas State Teachers College of Emporia was granted permission to publish and revise the Alpha examination by letter from the Surgeon General's Office, War Department, Washington, D. C., dated November 7, 1919. The accumulation of norms for school use was begun under the direction of James C. De Voss. In the present manual of directions,<sup>5</sup> revised by H. E. Schrammel and E. R. Wood, the norms supplied are computed from data for 27,808 students, ranging from fourth graders to college graduates.

Although the test was designed for adult men rather than for school use, it is still considered one of the best intelligence tests for examining adults and students in secondary schools and colleges.

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<sup>3</sup> Ibid., p. 342

<sup>4</sup> Rudolph Pintner, Intelligence Testing. (New York; Henry Holt Company, 1931), pp. 473-481.

<sup>5</sup> Army Alpha Intelligence Examination Manual, revised by H. E. Schrammel and E. R. Wood. (Emporia, Kansas; Bureau of Educational Measurements, Kansas State Teachers College, 1931), p. 10 ff.

## CHAPTER II

### OBJECTIVES OF THIS REVISION

While the Army Alpha intelligence test is widely used for measuring ability of students, and was found in early trials in school situations to yield satisfactory results,<sup>6</sup> it needs to be adapted for school use. This is more significant when one considers that even for adults, certain items of information current in the years 1917 to 1919 are no longer valid and should be eliminated from test 8.

The test was devised for administration to adult men, yet it is now used for measuring the intelligence of adolescent students of both sexes. As nearly as psychologists can determine, there are no differences in the intelligence of the sexes, yet the Army Alpha norms for girls are slightly lower than the corresponding norms for boys.<sup>7</sup> The elimination of certain items, especially some of those involving the less familiar military terms, should remove this disability.

The method of arranging the items in the order of their difficulty for college freshmen is described in Chapter III. Such rearrangement removed the probability that a student might not have had time to answer some easy items because they were preceded by difficult, time-consuming items.

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<sup>6</sup> Yoakum and Yerkes, Army Mental Tests. (New York; Henry Holt and Company, 1920), p. 189.

<sup>7</sup> Army Alpha Intelligence Examination Manual, revised by H. E. Schrammel and E. R. Wood. (Emporia, Kansas; Bureau of Educational Measurements, Kansas State Teachers College, 1931).

The Army Alpha examination was the pioneer group test of intelligence, although the Otis tests already existed in manuscript form and were borrowed freely in the preparation of the Army Alpha tests. Since then, notable advances have been made in the arrangement of tests for ease and objectivity of administration and scoring. Recently, self-administering tests have gained in popularity. Therefore it seemed advisable to modernize the Army Alpha test, not only by improving it statistically, but also by making it as nearly self-administering as possible, and easier to score.

## CHAPTER III

### DIFFICULTY OF ITEMS FOR COLLEGE FRESHMEN

The items within each test of the Army Alpha examination are not arranged in order of difficulty. When examination Alpha was constructed from examination a, only four of the eight parts retained were graded with respect to difficulty. For test 4 (synonym-antonym) and test 7 (analogies), an "attempt was made to rearrange the items in order of difficulty on the basis of examination records of a random group of privates." For test 3 and test 5, "the items were graded in difficulty on the basis of estimates made by the office force."<sup>8</sup> The basis for arrangement of the other four tests was not reported.

In the final criticism of the Alpha examination, Yerkes writes:<sup>9</sup>

Doubtless alpha could be improved. Many of its items are unsatisfactory and for no test are they arranged in order of difficulty . . . .

This statement is confirmed by an error study of the papers of the 553 freshmen who took entrance examinations at the Kansas State Teachers College of Emporia in September and October, 1934.

All freshmen took form 8. In addition, 88 of them took form 5, 88 took form 6, 95 took form 7, and 79 took form 9. This made a total of 903 papers studied.

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<sup>8</sup> Robert M. Yerkes, (op. cit., pp. 340-341.

<sup>9</sup> Ibid., p. 345.

A record of the number of incorrect responses and omissions was made for every item in each form of each test, except test 1, since a more fundamental change in this test was contemplated. From these data, the per cent wrong out of the number attempted was calculated for each item.\*

The per cent of incorrect attempts for each item in test 2 is shown in Table I. This table shows that all who attempted item 1, form 9, and item 5, form 6, worked the problem correctly, while none answered item 19, form 5, correctly.

In general, the difficulty of items increases through the test, yet there are a number of conspicuous exceptions in every form. In form 5, item 7 was missed by 19.77% of those who attempted it, whereas item 8 was missed by only 11.63%; item 10 was missed by 41.82%, whereas item 11 was missed by 24.10%; item 13 was missed by 57.58%, and item 14 by 17.39%; item 19 was missed by 100%, and item 20 by 12.50%. The reader may discover many more of these reversals by inspecting the tables.

Table II gives corresponding information for test 3. This is clearly a much easier test than test 2, since no errors were made for items 3, 5, 8, 9, and 12 in form 5, items 1, 4, and 7 in form 6, items 4 and 5 in form 7, items 4, 6, and 15 in form 8, and items 1 and 4 in form 9. The most dif-

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\* This figure was used rather than per cent correct, which was considered an inadequate measure of difficulty, because in most cases the number of omitted items due to failure to complete the test within the time limit was sufficient to produce a spurious effect of increasing difficulty of items from beginning to end, whereas actually the number of cases was

TABLE I

PER CENT WRONG OF ITEMS ATTEMPTED  
IN TEST 2 (ARITHMETIC REASONING)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	2.27	2.21	1.09	1.46	0.00
2	2.27	4.54	2.17	2.91	2.53
3	8.05	1.14	6.60	6.34	8.86
4	5.68	20.45	3.26	7.77	10.13
5	3.41	0.00	2.17	2.94	3.80
6	14.77	8.14	7.69	14.36	8.00
7	19.77	8.05	10.87	13.57	10.39
8	11.63	20.93	12.09	13.13	28.21
9	25.58	25.29	24.18	29.21	21.80
10	41.82	24.32	23.08	45.04	30.51
11	24.10	8.05	11.24	14.13	17.57
12	22.73	27.03	22.67	21.90	10.53
13	57.58	59.53	56.82	47.89	48.89
14	17.39	43.28	28.57	25.00	27.59
15	45.98	75.51	84.21	50.58	31.25
16	30.30	58.70	56.60	50.00	51.43
17	30.00	34.78	21.88	19.23	11.11
18	21.74	30.44	16.67	28.00	19.23
19	100.00	76.92	62.50	62.50	80.00
20	12.50	30.00	28.57	41.67	50.00

Read table thus; The percentage of incorrect attempts in the various forms for item 1 was; form 5, 2.27; form 6, 2.21; form 7, 1.09; and so on.

The percentages for form 5 were obtained for 88 cases; for form 6, 88 cases; for form 7, 92 cases; for form 8, 206 cases; and for form 9, 79 cases.



TABLE II

PER CENT WRONG OF ITEMS ATTEMPTED  
IN TEST 3 (PRACTICAL JUDGMENT)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	1.14	0.00	1.09	0.49	3.00
2	2.27	8.05	2.17	1.94	7.60
3	0.00	1.14	8.70	5.83	5.06
4	2.33	0.00	0.00	0.00	0.00
5	0.00	2.27	0.00	0.49	1.27
6	9.06	1.14	6.52	0.00	2.53
7	10.23	0.00	3.30	3.40	12.02
8	0.00	3.45	15.59	1.00	10.26
9	0.00	4.76	5.95	58.73	6.49
10	5.19	2.41	4.17	29.63	1.37
11	1.41	13.51	23.73	16.03	11.59
12	0.00	12.70	9.30	2.68	16.07
13	3.70	2.13	2.44	8.14	19.57
14	19.15	19.44	14.29	29.63	38.24
15	20.00	4.54	5.00	0.00	12.50
16	70.37	23.08	5.56	58.84	47.37

Read table thus: The percentage of incorrect attempts in the various forms for item 1 was; form 5, 1.14; form 6, 0.00; form 7, 1.09; and so on.

TABLE III

PER CENT WRONG OF ITEMS ATTEMPTED  
IN TEST 4 (SYNONYM-ANTONYM)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	0.00	0.00	1.09	0.00	1.27
2	0.00	1.14	1.09	0.97	0.00
3	1.15	3.45	8.70	9.22	3.80
4	1.14	2.27	0.00	4.37	0.00
5	18.18	1.14	4.35	0.49	1.27
6	2.27	6.82	3.26	3.47	0.00
7	3.41	0.00	2.17	17.48	10.13
8	0.00	7.95	8.70	25.12	1.27
9	2.33	11.49	3.26	9.43	11.39
10	0.00	9.06	24.18	5.42	7.60
11	18.18	19.76	16.48	9.71	13.92
12	14.77	4.60	8.70	1.46	16.46
13	2.27	11.49	3.26	4.90	5.06
14	8.05	3.41	13.96	15.27	2.53
15	9.34	15.91	15.22	11.71	23.08
16	11.49	32.18	8.79	0.98	20.25
17	37.65	14.77	21.11	3.90	34.62
18	12.79	44.71	42.39	14.71	12.66
19	21.69	21.43	40.91	0.00	15.19
20	12.64	31.71	37.50	13.48	1.28
21	18.60	19.05	36.67	16.42	19.48
22	12.64	17.05	14.70	36.60	20.51
23	44.71	20.00	21.35	31.98	17.11
24	19.76	12.35	33.71	19.37	53.52
25	64.71	14.10	10.00	13.78	60.27
26	36.25	3.81	49.99	42.05	12.68
27	17.86	28.36	16.67	41.38	30.00
28	34.18	50.00	39.24	40.80	36.76
29	12.00	41.82	27.85	27.78	18.03
30	33.33	57.14	55.70	16.13	38.33
31	42.19	27.45	7.46	7.14	29.41
32	46.66	14.00	55.17	42.97	34.78
33	40.00	77.50	18.87	12.93	50.00
34	33.96	72.98	39.22	47.62	16.67
35	39.13	39.39	24.44	46.24	8.82
36	41.18	44.45	51.22	21.92	38.71
37	39.39	48.00	16.67	55.56	30.44
38	50.00	52.63	51.35	44.64	60.00
39	58.62	55.56	52.78	44.00	45.00
40	46.04	55.56	23.27	57.14	45.00

Read table thus: The percentage of incorrect attempts in the various forms for item 1 was; form 5, 0.00; form 6, 0.00; form 7, 1.09; and so on.

TABLE IV  
 PER CENT WRONG OF ITEMS ATTEMPTED  
 IN TEST 5 (DISARRANGED SENTENCES)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	0.00	0.00	2.17	21.46	1.27
2	0.00	6.82	8.70	10.24	1.27
3	4.54	3.41	1.09	3.92	1.27
4	0.00	0.00	2.17	3.43	1.27
5	5.68	1.14	4.35	5.68	1.27
6	1.14	0.00	4.35	8.82	1.28
7	4.64	1.14	5.44	1.99	6.33
8	0.00	15.12	1.09	4.43	1.27
9	4.64	5.75	5.44	1.97	3.85
10	1.14	14.20	1.09	6.93	13.92
11	9.23	5.68	7.61	14.60	24.36
12	2.28	11.63	6.52	4.54	5.13
13	18.60	3.53	13.96	2.04	1.28
14	3.45	37.04	8.79	3.76	31.08
15	7.95	2.41	9.89	4.40	45.07
16	24.10	26.83	15.91	11.54	2.97
17	3.70	13.58	22.35	14.61	14.93
18	3.90	11.69	7.23	6.21	12.31
19	22.78	12.86	4.05	11.51	20.69
20	6.35	27.69	9.86	9.30	17.65
21	24.25	11.47	30.88	6.14	31.83
22	7.27	27.59	16.18	41.00	4.88
23	10.87	25.00	22.95	29.73	34.21
24	14.29	16.67	44.83	31.43	15.63

Read table thus: The percentage of incorrect attempts for the various forms for item 1 was: form 5, 0.00; form 6, 0.00; form 7, 2.17; and so on.

TABLE V

PER CENT WRONG OF ITEMS ATTEMPTED IN  
TEST 6 (NUMBER SERIES COMPLETION)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	2.28	1.14	0.00	1.46	1.27
2	2.28	1.14	0.00	3.40	1.27
3	1.14	2.28	1.09	1.46	0.00
4	3.41	10.23	14.13	22.82	3.80
5	9.20	22.73	2.20	4.41	8.86
6	9.09	9.30	7.61	10.24	10.13
7	14.77	11.49	10.00	14.50	11.39
8	18.39	14.20	25.00	28.43	10.67
9	22.09	17.86	8.70	21.96	21.05
10	4.60	43.04	10.00	15.71	3.80
11	47.62	7.23	50.62	54.75	36.49
12	42.42	38.33	18.60	37.71	42.37
13	24.05	29.33	39.29	55.73	16.67
14	32.08	40.32	18.46	29.77	33.33
15	35.19	25.53	32.08	47.89	11.37
16	38.71	11.36	10.20	54.06	20.00
17	50.00	24.32	52.38	33.33	3.57
18	20.00	50.00	64.71	58.33	47.62
19	72.72	16.67	21.43	38.46	44.45
20	50.00	25.00	53.33	50.00	62.50

Read table thus; The percentage of incorrect attempts in the various forms for item 1 was; form 5, 2.28; form 6, 1.14; form 7, 0.00; and so on.

TABLE VI

PER CENT WRONG OF ITEMS ATTEMPTED  
IN TEST 7 (ANALOGIES)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	1.14	0.00	0.00	0.99	1.27
2	0.00	2.28	0.00	0.00	1.27
3	1.14	1.14	0.00	11.27	3.85
4	3.41	13.79	2.17	15.69	6.33
5	2.28	17.05	3.26	3.45	6.33
6	1.14	29.88	7.61	2.95	13.92
7	1.14	3.41	1.09	13.61	8.86
8	5.75	2.30	7.61	0.00	16.46
9	4.54	3.45	3.26	11.27	5.06
10	4.54	33.33	6.52	10.34	10.26
11	5.68	5.68	4.35	1.47	6.33
12	2.28	13.79	2.17	16.75	3.80
13	1.14	7.95	20.65	10.34	21.80
14	3.41	12.64	2.17	10.34	24.68
15	11.36	21.84	3.26	13.76	28.57
16	1.14	12.64	21.74	15.76	12.99
17	12.50	10.34	9.89	4.94	24.00
18	16.09	2.33	4.40	17.31	2.63
19	0.00	10.47	16.67	16.42	29.33
20	12.50	6.90	22.22	32.83	9.46
21	9.20	4.65	13.33	24.00	5.48
22	25.58	8.14	1.12	1.52	2.78
23	11.49	2.30	1.25	14.43	38.03
24	12.64	10.59	11.36	5.67	4.35
25	19.76	63.10	6.90	32.11	7.58
26	6.98	21.69	0.00	12.02	12.90
27	9.30	13.27	3.69	11.89	5.17
28	14.12	48.72	22.09	49.99	29.63
29	7.14	11.14	4.76	11.04	6.00
30	11.25	6.06	25.00	1.29	24.93
31	25.00	28.12	22.50	30.07	5.13
32	18.42	9.53	7.79	15.75	17.65
33	8.33	22.58	50.63	10.19	12.50
34	44.77	5.00	18.67	11.81	30.00
35	7.94	17.54	16.67	10.00	37.50
36	40.74	11.28	38.71	13.04	8.70
37	46.81	9.52	50.00	21.95	13.64
38	71.43	8.33	31.37	9.33	31.25
39	21.62	11.54	60.00	13.88	36.36
40	51.43	19.92	82.61	38.71	0.00

Read table thus; The percentage of incorrect attempts in the various forms for item 1 was; form 5, 1.14; form 6,

TABLE VII

PER CENT WRONG OF ITEMS ATTEMPTED  
IN TEST 8 (INFORMATION)

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	1.14	4.54	3.26	0.49	0.00
2	10.59	62.52	39.13	10.84	34.61
3	1.14	2.28	24.18	13.00	1.27
4	9.09	36.47	50.00	17.24	6.33
5	12.50	44.19	59.78	41.46	53.16
6	4.54	1.14	17.58	0.97	2.53
7	33.33	30.86	81.11	54.26	39.23
8	5.75	39.29	52.75	24.37	22.78
9	76.19	71.01	80.00	21.00	61.04
10	14.20	80.95	89.01	47.96	3.80
11	27.38	41.56	0.00	22.39	25.32
12	36.36	17.86	30.77	35.64	58.47
13	53.57	51.16	38.04	83.25	40.51
14	5.68	29.55	17.58	49.51	40.51
15	26.14	1.14	5.44	2.44	17.72
16	34.09	49.37	34.07	32.99	64.94
17	68.67	47.56	16.30	40.51	47.44
18	14.12	25.00	14.13	12.43	24.36
19	3.41	27.85	58.70	7.43	2.56
20	15.12	54.22	50.47	17.10	34.21
21	22.73	21.43	60.00	20.10	50.65
22	8.14	40.74	35.26	3.96	25.08
23	30.95	15.12	48.86	8.50	77.33
24	4.60	24.10	16.67	5.08	3.90
25	23.26	65.69	7.06	6.84	8.00
26	6.82	51.72	62.20	3.52	15.58
27	36.36	24.77	82.71	50.55	65.28
28	71.69	27.71	46.34	7.81	32.00
29	56.79	0.00	77.78	93.86	41.43
30	90.00	29.76	16.25	8.46	46.27
31	50.00	78.21	16.46	38.73	31.34
32	44.30	42.86	40.51	68.35	49.23
33	3.49	7.50	37.18	2.72	12.31
34	83.95	63.89	93.42	8.98	1.52
35	26.58	45.07	59.46	1.13	20.00
36	80.00	26.76	33.80	19.53	3.45
37	29.63	4.05	43.66	2.96	0.00
38	41.56	75.71	78.26	82.10	37.50
39	31.65	43.08	32.39	94.90	67.67
40	7.14	4.41	10.00	37.97	52.94

Read table thus: The percentage of incorrect attempts in the various forms for item 1 was; form 5, 1.14; form 6,

difficult item was 16 in form 5, which was missed by 70.37% of those who attempted it.

Tables III to VII show the per cent of incorrect attempts for all items in tests 4 to 8.

The percentages were then converted into difficulty values in sigma units (fractional parts of the total area under the normal probability curve, corresponding to distances on the baseline between the mean and successive points laid off from the mean in units of standard deviation.) These difficulties are shown in Tables VIII to XIV.

The reader will recall that an item having a difficulty value of 0 is at the center of the difficulty distribution; that is, 50% of the group answer the item correctly and 50% answer it incorrectly. If an item is so easy that 100% of the group answer it correctly, it is at the extreme left of the normal probability curve and has a difficulty value of -3 sigmas. If it has maximum difficulty, being answered incorrectly by 100%, then it is at the extreme right end of the normal probability curve and has a difficulty value of +3 sigmas.

Table VIII shows that in test 2, item 16, form 8, and item 20, form 9, have 0 difficulty value or were missed by 50% of the group. The mean difficulty of items in test 2, form 5, is -0.75; that is, 22.66% of the group would miss an item having mean difficulty, such as item 12.\*

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\* The mean of the percentages in Table I would not be 22.66%, since the linear relationship is changed. The equation of the normal probability curve is  $y = e^{-x^2}$ . The sigma difficulty values are such that equal differences represent equal increments of difficulty; this is not true of equal percentage differences.

TABLE VIII  
 DIFFICULTY VALUES IN SIGMA UNITS  
 OF ITEMS IN TEST 2

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-2.00	-2.01	-2.29	-2.18	-3.00
2	-2.00	-1.69	-2.02	-1.89	-1.96
3	-1.40	-2.28	-1.51	-1.53	-1.35
4	-1.58	-0.83	-1.84	-1.42	-1.27
5	-1.82	-3.00	-2.02	-1.89	-1.77
6	-1.05	-1.40	-1.43	-1.06	-1.41
7	-0.85	-1.40	-1.23	-1.10	-1.26
8	-1.19	-0.81	-1.17	-1.12	-0.58
9	-0.66	-0.67	-0.70	-0.55	-0.78
10	-0.21	-0.70	-0.74	-0.12	-0.51
11	-0.70	-1.40	-1.21	-1.07	-0.93
12	-0.75	-0.61	-0.75	-0.78	-1.25
13	0.19	0.24	0.17	-0.05	-0.03
14	-0.94	-0.17	-0.57	-0.67	-0.60
15	-0.10	0.69	1.00	0.01	-0.49
16	-0.52	0.22	0.17	0.00	0.04
17	-0.52	-0.39	-0.78	-0.87	-1.22
18	-0.82	-0.51	-0.97	-0.58	-0.87
19	3.00	0.74	0.32	0.32	0.84
20	-1.15	-0.52	-0.57	-0.21	0.00

Read table thus; The difficulty value in sigma units in the various forms for item 1 was; form 5, -2.00; form 6, -2.01; form 7, -2.29; and so on.

These figures were obtained by converting the percentages in Table I into sigma units.



TABLE IX  
 DIFFICULTY VALUES IN SIGMA UNITS  
 OF ITEMS IN TEST 3

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-2.28	-3.00	-2.29	-2.58	-3.00
2	-2.00	-1.40	-2.02	-2.07	-1.43
3	-3.00	-2.28	-1.36	-1.57	-1.64
4	-1.99	-3.00	-3.00	-3.00	-3.00
5	-3.00	-2.00	-3.00	-2.58	-2.24
6	-1.34	-2.28	-1.51	-3.00	-1.96
7	-1.27	-3.00	-1.84	-1.83	-1.13
8	-3.00	-1.82	-1.01	-2.33	-1.27
9	-3.00	-1.67	-1.56	0.22	-1.52
10	-1.63	-1.98	-1.73	-0.54	-2.21
11	-2.20	-1.10	-0.72	-0.99	-1.20
12	-3.00	-1.14	-1.32	-1.93	-0.99
13	-1.79	-2.03	-1.97	-1.40	-0.86
14	-0.87	-0.86	-1.07	-0.54	-0.30
15	-0.84	-1.69	-1.65	-3.00	-1.15
16	0.54	-0.74	-1.59	0.22	-0.07

Read table thus; The difficulty value in sigma units in the various forms for item 1 was; form 5, -2.28; form 6, -3.00; form 7, -2.29; and so on.

TABLE X  
DIFFICULTY VALUES IN SIGMA UNITS  
OF ITEMS IN TEST 4

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-3.00	-3.00	-2.29	-3.00	-2.24
2	-3.00	-2.28	-2.29	-2.34	-3.00
3	-2.27	-1.82	-1.36	-1.33	-1.77
4	-2.28	-2.00	-3.00	-1.71	-3.00
5	-0.91	-2.28	-1.71	-2.58	-2.24
6	-2.00	-1.49	-1.84	-1.82	-3.00
7	-1.82	-3.00	-2.02	-0.94	-1.27
8	-3.00	-1.41	-1.36	-0.67	-2.24
9	-1.99	-1.20	-1.84	-1.31	-1.21
10	-3.00	-1.34	-0.70	-1.61	-1.43
11	-0.91	-0.85	-0.97	-1.30	-1.08
12	-1.05	-1.69	-1.36	-2.18	-0.98
13	-2.00	-1.20	-1.84	-1.66	-1.64
14	-1.34	-1.82	-1.08	-1.03	-1.96
15	-1.32	-1.00	-1.03	-1.19	-0.74
16	-1.20	-0.46	-1.35	-2.33	-0.83
17	-0.31	-1.05	-0.80	-1.76	-0.40
18	-0.92	-0.13	-0.19	-1.09	-1.14
19	-0.78	-0.79	-0.23	-3.00	-1.03
20	-1.14	-0.48	-0.32	-1.10	-2.23
21	-0.89	-0.88	-0.34	-0.98	-0.86
22	-1.16	-0.95	-1.05	-0.34	-0.82
23	-0.13	-0.64	-0.79	-0.47	-0.95
24	-0.85	-1.16	-0.42	-0.86	0.09
25	0.38	-1.08	-1.28	-1.09	0.26
26	-0.35	-1.77	0.00	-0.20	-1.14
27	-0.92	-0.57	-0.97	-0.22	-0.52
28	-0.41	0.00	-0.27	-0.23	-0.34
29	-1.18	-0.21	-0.53	-0.59	-0.91
30	-0.43	0.18	0.14	-0.99	-0.30
31	-0.20	-0.60	-1.44	-1.47	-0.54
32	-0.08	-1.08	0.13	-0.18	-0.39
33	-0.25	0.76	-0.88	-1.13	0.00
34	-0.41	0.61	-0.27	-0.06	-0.97
35	-0.28	-0.27	-0.69	-0.09	-1.35
36	-0.22	-0.14	0.03	-0.77	-0.29
37	-0.27	-0.05	-0.97	0.14	-0.51
38	0.00	0.07	0.03	-0.03	0.25
39	0.22	0.14	0.07	-0.15	-0.39
40	-0.10	0.14	-0.60	0.18	-0.39

Read table thus: The difficulty value in sigma units in the various forms for item 1 was: form 5, -3.00; form 6,

TABLE XI  
 DIFFICULTY VALUES IN SIGMA UNITS  
 OF ITEMS IN TEST 5

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-3.00	-3.00	-2.02	-0.79	-2.24
2	-3.00	-1.49	-1.36	-1.27	-2.24
3	-1.69	-1.82	-2.29	-1.76	-2.24
4	-3.00	-3.00	-2.02	-1.82	-2.24
5	-1.58	-2.28	-1.71	-1.57	-2.24
6	-2.28	-3.00	-1.71	-1.35	-2.23
7	-1.68	-2.28	-1.60	-2.05	-1.53
8	-3.00	-1.12	-2.29	-1.70	-2.24
9	-1.68	-1.58	-1.60	-2.06	-1.77
10	-2.28	-1.07	-2.29	-1.48	-1.08
11	-1.33	-1.58	-1.43	-1.05	-0.69
12	-2.00	-1.19	-1.51	-1.69	-1.63
13	-0.89	-1.81	-1.08	-2.06	-2.23
14	-1.82	-0.33	-1.35	-1.78	-0.49
15	-1.41	-1.98	-1.29	-1.71	-0.12
16	-0.70	-0.62	-1.00	-1.20	-1.89
17	-1.79	-1.10	-0.76	-1.05	-1.04
18	-1.76	-1.19	-1.46	-1.54	-1.16
19	-0.75	-1.13	-1.75	-1.20	-0.82
20	-1.49	-0.59	-1.29	-1.32	-0.93
21	-0.70	-1.20	-0.50	-1.54	-0.47
22	-1.46	-0.60	-0.99	-0.23	-1.66
23	-1.23	-0.67	-0.74	-0.53	-0.41
24	-1.07	-0.97	-0.13	-0.48	-1.01

Read table thus: The difficulty value in sigma units in the various forms for item 1 was: form 5, -3.00; form 6, -3.00; form 7, -2.02; and so on.

TABLE XII

DIFFICULTY VALUES IN SIGMA UNITS  
OF ITEMS IN TEST 6

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-2.00	-2.28	-3.00	-2.18	-2.24
2	-2.00	-2.28	-3.00	-1.83	-2.24
3	-2.28	-2.00	-2.29	-2.18	-3.00
4	-1.82	-1.27	-1.07	-0.74	-1.77
5	-1.33	-0.75	-2.01	-1.71	-1.35
6	-1.34	-1.32	-1.43	-1.27	-1.27
7	-1.05	-1.20	-1.28	-1.06	-1.21
8	-0.90	-1.07	-0.67	-0.57	-1.24
9	-0.77	-0.92	-1.36	-0.77	-0.80
10	-1.69	-0.18	-1.28	-1.01	-1.77
11	-0.06	-1.46	0.02	0.12	-0.35
12	-0.19	-0.30	-0.89	-0.31	-0.19
13	-0.70	-0.54	-0.27	0.14	-0.97
14	-0.47	-0.25	-0.90	-0.53	-0.43
15	-0.38	-0.66	-0.47	-0.05	-1.21
16	-0.29	-1.21	-1.27	0.10	-0.84
17	0.00	-0.70	0.06	-0.43	-1.50
18	-0.84	0.00	0.38	0.21	-0.06
19	0.60	-0.97	-0.79	-0.29	-0.14
20	0.00	-0.67	0.08	0.00	0.32

Read table thus: The difficulty value in sigma units in the various forms for item 1 was; form 5, -2.00; form 6, -2.28; form 7, -3.00; and so on.

TABLE XIII  
 DIFFICULTY VALUES IN SIGMA UNITS  
 OF ITEMS IN TEST 7

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-2.28	-3.00	-3.00	-2.33	-2.24
2	-3.00	-2.00	-3.00	-3.00	-2.24
3	-2.28	-2.28	-3.00	-1.21	-1.77
4	-1.82	-1.09	-2.02	-1.01	-1.53
5	-2.00	-0.95	-1.84	-1.82	-1.53
6	-2.28	-0.53	-1.43	-1.89	-1.08
7	-2.28	-1.82	-2.29	-1.25	-1.35
8	-1.58	-2.00	-1.43	-3.00	-0.98
9	-1.69	-1.82	-1.84	-1.21	-1.64
10	-1.69	-0.43	-1.51	-1.26	-1.27
11	-1.58	-1.58	-1.71	-1.20	-1.53
12	-2.00	-1.09	-2.02	-0.96	-1.77
13	-2.28	-1.41	-0.82	-1.26	-0.78
14	-1.82	-1.16	-2.02	-1.26	-0.68
15	-1.21	-0.78	-1.84	-1.09	-0.57
16	-2.28	-1.16	-0.78	-1.00	-1.13
17	-1.15	-1.26	-1.29	-1.65	-0.71
18	-0.99	-1.99	-1.71	-0.94	-1.92
19	-3.00	-1.25	-0.97	-0.98	-0.54
20	-1.15	-1.48	-1.16	-0.44	-1.31
21	-1.33	-1.68	-1.11	-0.71	-1.60
22	-0.66	-1.40	-2.28	-2.17	-1.91
23	-1.20	-2.00	-2.24	-1.06	-0.30
24	-1.16	-1.25	-1.21	-1.58	-1.71
25	-0.85	0.33	-1.48	-0.46	-0.54
26	-1.48	-0.78	-3.00	-1.17	-1.13
27	-1.32	-1.11	-1.79	-1.18	-1.03
28	-1.08	-0.03	-0.77	0.00	-0.54
29	-1.46	-1.22	-1.67	-1.22	-1.56
30	-1.21	-1.55	-0.67	-2.00	-0.68
31	-0.67	-0.58	-0.76	-0.51	-1.63
32	-0.90	-1.31	-1.42	-1.00	-0.93
33	-1.38	-0.75	0.02	-1.27	-1.15
34	-0.13	-1.65	-0.89	-1.18	-0.52
35	-1.41	-1.06	-0.97	-1.28	-0.32
36	-0.23	-1.21	-0.29	-1.12	-1.36
37	-0.08	-1.31	0.00	-0.77	-1.10
38	0.57	-1.38	-0.49	-1.32	-0.49
39	-0.78	-1.20	0.25	-1.09	-0.35
40	0.04	-0.84	0.94	-0.29	-3.00

Read table thus: The difficulty value in sigma units in the various forms for item 1 was: form 5, -2.28; form 6, -3.00; form 7, -3.00; and so on.

TABLE XIV

DIFFICULTY VALUES IN SIGMA UNITS  
OF ITEMS IN TEST 8

Item	Form 5	Form 6	Form 7	Form 8	Form 9
1	-2.28	-1.69	-1.84	-2.58	-3.00
2	-1.25	0.32	-0.28	-1.24	-0.40
3	-2.28	-2.00	-0.70	-1.13	-2.24
4	-1.34	-0.35	0.00	-0.94	-1.53
5	-1.15	-0.15	0.25	-0.22	0.08
6	-1.69	-2.28	-0.93	-2.34	-1.96
7	-0.43	-0.50	0.88	0.11	-0.27
8	-1.58	-0.27	0.07	-0.69	-0.75
9	0.71	0.55	0.84	-0.81	0.28
10	-1.07	0.88	1.23	-0.05	-1.77
11	-0.61	-0.21	-3.00	-0.76	-0.66
12	-0.35	-0.92	-0.50	-0.37	0.21
13	0.09	0.03	-0.30	0.96	-0.24
14	-1.58	-0.54	-0.93	-0.01	-0.24
15	-0.64	-2.28	-1.60	-1.97	-0.93
16	-0.41	-0.02	-0.41	-0.44	0.38
17	0.49	-0.06	-0.98	-0.24	-0.06
18	-1.08	-0.67	-1.07	-1.15	-0.69
19	-1.82	-0.59	0.22	-1.44	-1.95
20	-1.03	0.11	0.01	-0.95	-0.41
21	-0.75	-0.79	0.25	-0.84	0.02
22	-1.40	-0.23	-0.35	-1.75	-0.74
23	-0.50	-1.03	-0.03	-1.37	0.75
24	-1.69	-0.70	-0.97	-1.64	-1.76
25	-0.73	0.40	-1.47	-1.49	-1.41
26	-1.49	0.04	0.31	-1.81	-1.01
27	-0.35	-0.68	0.94	0.01	0.39
28	0.57	-0.59	-0.09	-1.42	-0.47
29	0.17	-3.00	0.76	1.54	-0.22
30	0.84	-0.53	-0.98	-1.37	-0.09
31	0.00	0.78	-0.98	-0.29	-0.49
32	-0.14	-0.18	-0.24	0.48	-0.02
33	-1.81	-1.44	-0.33	-1.92	-1.16
34	0.99	0.36	1.51	-1.34	-2.17
35	-0.63	-0.12	0.24	-2.28	-0.84
36	0.84	-0.62	-0.42	-0.66	-1.82
37	-0.54	-1.75	-0.16	-1.89	-3.00
38	-0.21	0.70	0.78	0.92	-0.32
39	-0.48	-0.17	-0.46	1.64	0.46
40	-1.47	-1.71	-1.28	-0.31	0.07

Read table thus: The difficulty value in sigma units in the various forms for item 1 was: form 5, -2.28; form 6, -1.69; form 7, -1.84; and so on.

For convenience in selecting items for the revised tests, and to show the distributions clearly, tables were prepared with items rearranged in order of difficulty. Table XV shows the items of test 2 rearranged in order of difficulty. These tables indicate that the items are unevenly distributed in the five forms, making the forms of unequal difficulty.

These inequalities between forms are summarized for all the tests in Table XVI, which shows the mean, median, first quartile, and third quartile of the distribution of item difficulty in each form of each test.

Items were then selected from these tables for three forms of the revised test. These items were not only arranged in order of difficulty within each test, but were also selected so that the mean difficulties of the different forms are equal.\*

In test 2, there are twenty types of items, the forms being varied by substituting different numbers in the problems. Therefore, in revising test 2, the problem was complicated by the necessity of including all twenty types, with no duplications, in each form. Similar problems were encountered in the revision of tests 6 and 8.

After the obsolete items were eliminated, three new items were needed in test 8. A list of seventeen items was given to 89 freshmen, and an error study made in the manner already described; then three items were selected for insertion in test 8.#

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\* See Appendix II for tables of difficulties of items selected for the revised form.

# See Appendix III for items and difficulties.

TABLE XV

ITEMS IN TEST 2 REARRANGED  
IN ORDER OF DIFFICULTY

Form 5		Form 6		Form 7		Form 8		Form 9	
1	-2.00	5	-3.00	1	-2.29	1	-2.18	1	-3.00
2	-2.00	3	-2.28	2	-2.02	2	-1.89	2	-1.96
5	-1.82	1	-2.01	5	-2.02	5	-1.89	5	-1.77
4	-1.58	2	-1.69	4	-1.84	3	-1.53	6	-1.41
3	-1.40	6	-1.40	3	-1.51	4	-1.42	3	-1.35
8	-1.19	7	-1.40	6	-1.43	8	-1.12	4	-1.27
20	-1.15	11	-1.40	7	-1.23	7	-1.10	7	-1.26
6	-1.05	4	-0.83	11	-1.21	11	-1.07	12	-1.25
14	-0.94	8	-0.81	8	-1.17	6	-1.06	17	-1.22
7	-0.85	10	-0.70	18	-0.97	17	-0.87	11	-0.93
18	-0.82	9	-0.67	17	-0.78	12	-0.78	18	-0.87
12	-0.75	12	-0.61	12	-0.75	14	-0.67	9	-0.78
11	-0.70	20	-0.52	10	-0.74	18	-0.58	14	-0.60
9	-0.66	18	-0.51	9	-0.71	9	-0.55	8	-0.58
16	-0.52	17	-0.39	14	-0.57	20	-0.21	10	-0.51
17	-0.52	14	-0.17	20	-0.57	10	-0.12	15	-0.49
10	-0.21	16	0.22	13	0.17	13	-0.05	13	-0.03
15	-0.10	13	0.24	16	0.17	16	0.00	20	0.00
13	0.19	15	0.69	19	0.32	15	0.01	16	0.04
19	3.00	19	0.74	15	1.00	19	0.32	19	0.84

Read table thus: The easiest item in form 5 was item 1, sigma difficulty value -2.00; in form 6, item 5, difficulty value -3.00; in form 7, item 1, difficulty value -2.29; and so on.



TABLE XVI

MEAN, MEDIAN, FIRST QUARTILE, AND THIRD QUARTILE  
OF THE DISTRIBUTION OF ITEM DIFFICULTY  
IN EACH TEST

	Test	Form 5	Form 6	Form 7	Form 8	Form 9
Mean	2	-0.75	-0.83	-0.87	-0.84	-0.92
	3	-1.92	-1.67	-1.73	-1.68	-1.50
	4	-1.04	-0.92	-0.94	-1.09	-1.09
	5	-1.73	-1.48	-1.42	-1.49	-1.44
	6	-0.88	-1.00	-1.07	-0.71	-1.13
	7	-1.38	-1.28	-1.39	-1.25	-1.21
	8	-0.70	-0.55	-0.30	-0.81	-0.75
	Median	2	-0.84	-0.69	-0.88	-0.83
3		-2.00	-1.89	-1.62	-1.88	-1.35
4		-1.04	-0.92	-0.93	-1.06	-0.96
5		-1.68	-1.20	-1.45	-1.51	-1.58
6		-0.81	-0.95	-0.99	-0.55	-1.21
7		-1.36	-1.25	-1.43	-1.19	-1.14
8		-0.64	-0.43	-0.29	-0.90	-0.48
Q <sub>1</sub>		2	-1.29	-1.40	-1.47	-1.27
	3	-3.00	-2.28	-2.00	-2.58	-2.09
	4	-1.58	-1.45	-1.36	-1.64	-1.54
	5	-2.14	-1.90	-1.73	-1.74	-2.24
	6	-1.52	-1.30	-1.40	-1.17	-1.77
	7	-1.91	-1.62	-1.93	-1.30	-1.62
	8	-1.44	-0.86	-0.95	-1.47	-1.47
	Q <sub>3</sub>	2	-0.52	-0.28	-0.57	-0.17
3		-1.31	-1.27	-1.34	-0.54	-0.93
4		-0.28	-0.18	-0.30	-0.29	-0.40
5		-1.28	-1.20	-1.04	-1.13	-0.88
6		-0.24	-0.60	-0.37	-0.03	-0.39
7		-0.95	-1.01	-0.80	-0.99	-0.68
8		-0.18	0.00	0.25	-0.25	-0.04

Read table thus: The mean sigma difficulty value of items in test 2, form 5, was -0.75; in test 2, form 6, was -0.83; and so on. The median difficulty value of items in test 2, form 5, was -0.84; in test 2, form 6, was -0.69; and so on.

These difficulties as determined are not necessarily valid for groups other than college freshmen; a somewhat different distribution might conceivably have been obtained from the papers of junior high school pupils. However, the data obtained were considered adequate as a basis for revision, since the test is possibly most useful at the level investigated.

## CHAPTER IV

### ADMINISTRATION OF THE TEST

Two changes were contemplated in order to make the test more easily administered; first, changing the oral directions test to a written directions test, and second, the removal of time limits on the separate tests.

### REVISION OF TEST I

Studies made previously have indicated that a written directions test would be as valid as an oral directions test.

In the summer of 1934, Lester Cross, a student in the graduate division of the Kansas State Teachers College of Emporia, examined 289 negro workers in the Civilian Conservation Corps who were constructing a dam in Reading Township, Lyon County, Kansas. They were given form 8 of the Army Alpha examination, also test 1, form 9, with written directions, and test 39 of the Kuhlmann-Anderson intelligence test, which requires performance of written directions.

The correlation between test 1, form 8 of Army Alpha, and test 1, form 9 with written directions was  $.65 \pm .019$ .

This correlation between tests with oral and written directions was nearly as high as the correlation of  $.69 \pm .021$  between two tests with written directions, test 1, form 9 of Army Alpha, with Kuhlmann-Anderson test 39. The latter test was given to 278 men.

The same tests were given to 55 students of educational measurements in the Kansas State Teachers College of Emporia

in the summer of 1934. The correlation between oral and written directions for test 1, Army Alpha, was  $.56 \pm .06$ ; the correlation between test 1, form 9, Army Alpha with written directions and Kuhlmann-Anderson test was  $.61 \pm .06$ .

The old test was time-consuming both in administering and scoring. Therefore, in an attempt to improve the method of scoring also, a test with twenty completely objective items was prepared and given to 78 psychology students, most of whom were freshmen.\*

The first eight items were adapted in the following manner from those in the original test 1; The same or similar figures were used, with responses already marked. Three statements about each figure were given, and the correct description was to be chosen.

Four items were multiple-choice geometrical analogies, and the last eight items involved following directions, with the response recorded in the parenthesis.

An error study revealed that the first eight items had almost no differentiating value for college freshmen, but the other two types were satisfactory.

Fifty-three of the students who took this test had taken the entrance examinations in September, 1934. The correlation of the experimental test 1 scores with the total scores on form 8 was  $.563 \pm .0633$ .

The test finally arranged for use in the first experimental edition of the revised test is made as follows: The first six items are arranged from the first four items of

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\* See Appendix III for a copy of this test.

the old Army Alpha test. The figures are to be marked according to written directions. The next six items give directions for responses to be written in parenthesis, and the four geometrical analogies complete the test.

#### TIME ALLOTMENTS

The problem of time limits will require further study. If trials of the preliminary edition of the revision show a single time limit for the entire examination to be satisfactory, the examination can be made completely self-administering.

There are two problems involved in fixing the time limits: first, deciding whether the test shall be a speed or a power test, and adjusting limits accordingly; and second, insuring fair apportionment of working time to the various parts.

The actual working time for the regular examination is  $22\frac{1}{2}$  minutes, but it requires thirty-five to forty minutes or more to administer.

The time limits for the original Army Alpha test were carefully determined. Before Test a was published, "the time allowances for the tests were checked up by noting the per cent in each group who attempted all the items of a test."<sup>10</sup> Some of the limits decided upon then were altered when the Alpha examination was made.

At first, men who made low scores on examination a were recalled to take examination b, which consisted of tests

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<sup>10</sup> Ibid., p. 305.

3 to 9 of examination a with double time allotments. It was believed that examination b would give a fairer measure for men whose low scores in the first examination were due to slowness of reaction rather than inferior intelligence, and would check the first test.<sup>11</sup>

The probable error of the score was reduced, though not enough to justify the second test. The slow but intelligent person evidently proved to be a fictitious character;

The expectation that many men of fair intelligence would make low scores in examination a because of slow mental processes looked reasonable enough, but it is not borne out by the facts.<sup>12</sup>

Specific cases of officers or men considered unusually rapid thinkers or especially slow thinkers were compared. Enough evidence accumulated to show that personal estimates of quick or slow thinkers were not borne out by the scores. Men of recognized ability made scores roughly equivalent to such ability in comparison with those made by other men of different standing . . . .<sup>13</sup>

Since the longer time allotment did not change the relative standing of the men, and the unit commanders needed the results the following day for guidance in organizing their units, the use of examination b was soon discontinued.

Henry P. Smith, a graduate student in the Kansas State Teachers College of Emporia in 1935, found a correlation of  $.637 \pm .044$  between the scores of 83 7A pupils in Lowther Junior High School, Emporia, Kansas, on test 2 of form 7, administered in the usual manner, with the regular time limit of five minutes, and test 2 of form 8, administered as a pow-

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<sup>11</sup> Ibid., pp. 320-1; p. 415ff.; p. 480ff.

<sup>12</sup> Ibid., p. 321.

<sup>13</sup> Ibid., p. 483.

er test with a fifteen minute time allotment.\*

These studies seem to show that the value of the test would not be affected by increasing the working time. The remaining problem is whether a convenient period, such as forty minutes, will be sufficient to enable nearly all the subjects examined to try all parts of the test. The low intercorrelations of the different parts of the examination indicate that they test diverse phases of intelligence, therefore all parts should be attempted. To accomplish this, it may prove necessary to make two or three general divisions in the examination with time limits on each.

#### ORAL DIRECTIONS

There seems to be no reason for elaborate oral directions read by the examiner before each part is begun, considering that the examination requires reading ability. In fact, the oral reading of detailed directions by the examiner was omitted in the examiner's guide prepared by Terman for the examination of men in Students' Army Training Corps shortly before the close of the war.<sup>14</sup> The time limits were lengthened correspondingly.

Even though time limits on parts may be retained, only the general directions for the revised test need be read by the examiner to the subjects.

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\* Unpublished study by Henry Peter Smith. Similar data for a larger number of cases, for both test 2 and test 7, will be available soon.

<sup>14</sup> Yoakum and Yerkes, op. cit., p. 153; p. 157ff.

CHAPTER V

SCORING OF THE TEST

In order to make the test easier to score, the scoring of all items has been made completely objective, and the items are so stated that they may be scored efficiently with a strip key. Several parts of the original test required the use of celluloid stencils for rapid scoring, and the use of the inexpensive strip keys was made unnecessarily long and troublesome.

The items are rearranged thus:

Test 3. Original Form

4 The main reason why stone is used for building purposes is because

- it makes a good appearance
- it is strong and lasting
- it is heavy

Revised Form

( 1 ) 1. The main reason why stone is used for building purposes is because 1. it makes a good appearance 2. it is strong and lasting 3. it is heavy

Test 4. Original Form

2 slow - fast . . . . . same - opposite 2

Revised Form

( - ) 1. slow - fast

Test 5. Original Form

1 iron heavy is . . . . . true .. false 1

Revised Form

( + ) 1. iron heavy is



Test 6, Original Form

2      3      4      5      6      7      1      1

Revised Form

1.      2      3      4      5      6      7      1

Test 7, Original Form

1 bird--sings;;dog-- fire barks snow flag . . . . . 1

Revised Form

( 2 ) 1. bird--sings;;dog-- 1. fire 2. barks 3. snow 4. flag

Test 8, Original Form

11 Alfalfa is a kind of hay corn fruit rice . . . . . 11

Revised Form

( / ) 1. Alfalfa is a kind of 1. hay 2. corn 3. fruit 4. rice

The changes in tests 3, 4, 5, 7, and 8 are changes in arrangement. In test 6, one response is required instead of two. Test 2 is unchanged, except for the deletion of the word answer preceding the parenthesis. Multiple choice items have been inserted in test 1.

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## CHAPTER VI

### CONCLUSION

4 The Army Alpha intelligence test has been revised to adapt it more fully for school use, and to conform to modern testing procedure.

In order to arrange the items in the new test in order of difficulty and to make the different forms of equal difficulty, an error study was made of the test papers of 553 freshmen entering Kansas State Teachers College of Emporia in the fall of 1934 who took the Army Alpha intelligence test in the battery of entrance examinations.

From this data the difficulties were determined according to the statistical procedure used in scaling items. The items for three revised forms were assembled, arranging the items in order of difficulty for college freshmen, and equating the mean difficulty of the forms.

In order to make the test more nearly self-administering, test 1 was changed from oral directions to written directions, and the time limits upon the parts were tentatively removed, since various studies indicated that these changes would not impair the efficacy of the test.

The test was made easy to score by the simple expedient of arranging the items according to modern practice in objective testing.

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## BIBLIOGRAPHY

Army Alpha Intelligence Examination Manual. Revised by H. E. Schrammel and E. R. Wood. Emporia, Kansas; Bureau of Educational Measurements, Kansas State Teachers College, 1931. 17 pp.

This manual contains the directions now used in administering the Army Alpha intelligence examination, and norms computed from the scores of 27,808 students.

Manual of Instructions, Army Alpha Intelligence Tests. Adapted and prepared by James C. De Voss. Emporia, Kansas; Kansas State Teachers College, 1923. 28 pp.

This manual reports the original standardization of the test for school use, listing sources of data.

Pintner, Rudolph, Intelligence Testing. New York; Henry Holt and Company, 1931. 555 pp.

The occupational norms obtained from analysis of draft data are summarized in convenient form, p. 473 ff. Data are also given concerning the intelligence of students in various colleges, relative intelligence of different races, nationalities, etc., as indicated by Army Alpha scores.

Yerkes, Robert M., editor, "Psychological Examining in the United States Army." National Academy of Sciences, Mem-oirs, Vol. XV. Washington; Government Printing Office, 1921. 890 pp.

This voluminous report gives detailed accounts of the history and organization of psychological examining and materials of examination, the history and development of the methods of examining and preliminary results, and the measurements of intelligence in the United States Army. It is the primary source of all information concerning the development of the tests and their use in the Army.

Yoakum, Clarence S., and Robert M. Yerkes, Army Mental Tests. New York; Henry Holt and Company, 1920. 303 pp.

The examiner's guide and test blanks used in Army testing are reproduced, and an abridged popular account of the way in which the tests were made and of the results obtained is included.

7/10/37

## APPENDIX A

### THE REVISED TESTS

On the following pages, the preliminary arrangement of the three revised forms is shown. The items are those selected and arranged according to their difficulty for college freshmen.\*

The old order of the tests is retained for convenient reference, although it will probably be changed, placing the present test 6, which is the most difficult, last, preceded by test 2, etc.

The directions are all subject to revision as actual trial may show them to be inadequate, lacking in clarity, or unnecessarily long.

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\* For the source of each item and its difficulty, see tables in Appendix B.

ARMY GROUP EXAMINATION ALPHA

Revised by Christine V. Brannan

Name \_\_\_\_\_ Age \_\_\_\_\_ Date \_\_\_\_\_

School \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_

School classification \_\_\_\_\_ Race \_\_\_\_\_ Sex \_\_\_\_\_

GENERAL DIRECTIONS; This is a test to see how well you can think. When you begin a part of the test, read the directions carefully. Unless the directions tell you to do otherwise, write the answer in the parenthesis, like this:

1. How many men are 5 men and 10 men? . . . . . (15)

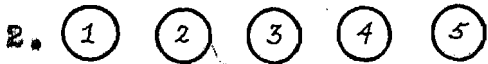
The test contains 220 questions. You are not expected to answer all of them correctly, but do the best you can. You will be allowed forty minutes. Go right through all the parts without stopping. Work as rapidly as you can without being careless. Do not spend too much time on any one question, but omit questions you cannot answer quickly and come back to them after you have finished the test. Do not ask questions after the test begins.

TEST 1

Mark the figures according to the following directions:

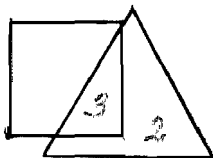


1. Make a cross in the first circle and also a figure 1 in the last circle.



2. Draw a line from Circle 2 to Circle 5 that will pass below Circle 3 and above Circle 4.

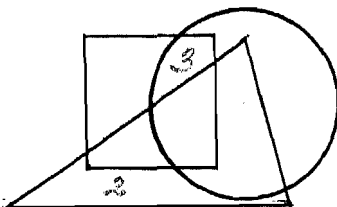
3-4



3. Make a figure 2 in the space which is in the triangle, but not in the square.

4. Make a figure 3 in the space which is in the square and the triangle.

5-6



5. Make a figure 2 in the space which is in the triangle, but not in the circle or square.

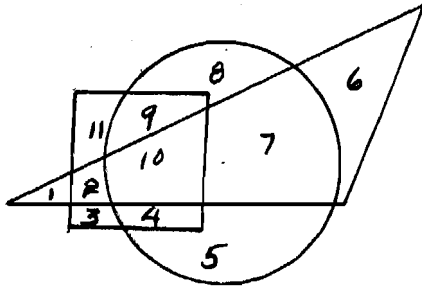
6. Make a figure 3 in the space which is in the square and circle, but not in the triangle.

TEST 1. (continued)

Write in the parenthesis what is asked:

7. Print the last letter of the word which is the opposite of wet . . . . . ( Y )

8. If 5 is more than 3, write the number 4, unless 4 is more than 6, in which case write the number 5 ( 4 )






9. What number is in the space which is in the triangle and circle but not in the square? ( 7 )




10. What number is in the same pair of geometrical figures as the number 4? . . . . . ( 7 )

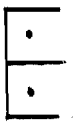


11. How many spaces are there that are in two and only two geometrical figures? . ( 4 )

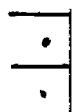
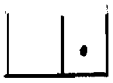

12. In a foreign language, lani dola means big trees, and reti dola means big women. Print the first letter of the foreign word for women . . . . . ( R )


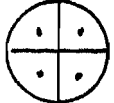
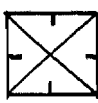
Write in the parenthesis the number of the figure which bears the same relationship to the third figure as the second does to the first:

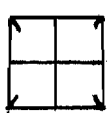

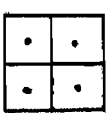
13.  is to  as  is to:


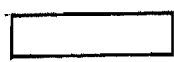
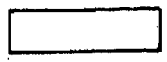
1.  2.  3.  . . . . . ( 3 )


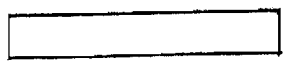
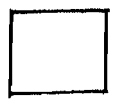
14.  is to  as  is to:

1.  2.  3.  . . . . . ( 2 )

15.  is to  as  is to:

1.  2.  3.  . . . . . ( 1 )

16.  is to  as  is to:

1.  2.  3.  . . . . . ( 2 )

## TEST 2

DIRECTIONS: Solve these problems as quickly as you can, writing the answers in the parenthesis.

- EXAMPLES: 1. How many are 5 men and 10 men? . . . . . (15)  
 2. If you walk 4 miles an hour for 3 hours, how far do you walk? . . . . . (12)

1. How many are 50 tents and 8 tents? . . . . . (58)
2. If you save \$5 a month for 7 months, how much will you save? . . . . . (35)
3. A truck drove forward 8 miles and backed 2 miles. How far was it then from its first position? . . . (6)
4. Mike had 12 cigars. He bought 3 more, and then smoked 6. How many cigars did he have left? . . . (9)
5. How many hours will it take a truck to go 48 miles at the rate of 4 miles an hour? . . . . . (12)
6. If 64 men are divided into teams of 8, how many teams will there be? . . . . . (8)
7. How many pencils can you buy for 30 cents at the rate of 2 for 5 cents? . . . . . (12)
8. A dealer bought some mules for \$1,000. He sold them for \$1200, making \$20 on each mule. How many mules were there? . . . . . (10)
9. A regiment marched 40 miles in five days. The first day they marched 9 miles, the second day 6 miles, the third 10 miles, the fourth 11 miles. How many miles did they march the last day? . . . . . (4)
10. If 341 squads of men are to dig 6,138 yards of trench, how many yards must be dug by each squad? (18)
11. A submarine goes 10 miles an hour under water and 20 miles an hour on the surface. How long will it take to cross a 100-mile channel if it has to go one-fifth of the way under water? . . . . . (6)
12. If it takes 8 men 2 days to dig a 160-foot drain, how many men are needed to dig it in half a day? . (16)
13. A rectangular bin holds 600 cubic feet of lime. If the bin is 10 feet wide and 5 feet deep, how long is it? . . . . . (12)
14. If  $4\frac{1}{2}$  tons of clover cost \$36, what will  $2\frac{1}{2}$  tons cost? . . . . . (18)

## TEST 2 (continued)

15. If you buy 2 packages of tobacco at 8 cents each and a pipe for 65 cents, how much change should you get from a two-dollar bill? . . . . . (1.10)
16. A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the remainder of its stock to 28 mess halls. Of this remainder each mess hall received 47 barrels. What was the total number of barrels supplied? . . . (3.20)
17. A ship has provisions to last her crew of 500 men 6 months. How long would it last 1,200 men? . . . (2.5)
18. If an airplane goes 250 yards in 10 seconds, how many feet does it go in a fifth of a second? . . . . (15)
19. A recruit spent one-eighth of his spare change for post cards and four times as much for a box of letter paper, and then had 30 cents left. How much money did he have at first? . . . . . ( )
20. A certain division contains 2,000 artillery, 15,000 infantry, and 1,000 cavalry. If each branch is expanded proportionately until there are in all 19,800 men, how many will be added to the artillery? ( )

## TEST 3

**DIRECTIONS:** This is a test of common sense. Below are twenty questions. Three answers are given to each question. Look at the answers carefully, and then write in the parenthesis the number of the best answer.

**EXAMPLES:** ( 2 ) Why do we use stoves? Because 1. they look well. 2. they keep us warm. 3. they are black.

Answer No. 2 is the best, so 2 is written in parenthesis.

( 3 ) 1. The main reason why stone is used for building purposes is because 1. it makes a good appearance 2. it is strong and lasting 3. it is heavy.

( / ) 2. If you are held up and robbed in a strange city, you should 1. apply to the police for help 2. ask the first man you meet for money to get home 3. borrow some money at a bank.



## TEST 3 (continued)

- (2) 3. Cotton fibre is much used for making cloth because  
1. it grows all over the South 2. it can be spun  
and woven 3. it is a vegetable product.
- (1) 4. Why ought a grocer to own an automobile? Because  
1. it is useful in his business 2. it uses rubber  
tires 3. it saves railroad fare.
- (1) 5. It is wiser to put some money aside and not spend it  
all, so that you may 1. prepare for old age and  
sickness 2. collect all the different kinds of  
money 3. gamble when you wish.
- (3) 6. All traffic going one way keeps to the same side of  
the street because 1. most people are right handed  
2. the traffic policeman insists on it 3. it avoids  
confusion and collisions.
- (1) 7. The cause of echoes is 1. the reflection of sound  
waves 2. the presence of electricity in the air  
3. the presence of moisture in the air.
- (1) 8. Why judge a man by what he does rather than by what  
he says? Because 1. what a man does shows what he  
really is 2. it is wrong to tell a lie 3. a deaf  
man cannot hear what is said.
- (1) 9. If you do not get a letter from home, which you know  
was written, it may be because 1. it was lost in  
the mails 2. you forgot to tell your people to  
write 3. the postal service has been discontinued.
- (2) 10. Why are warships painted gray? Because gray paint  
1. is cheaper than other colors 2. is more durable  
than other colors 3. makes the ships harder to see.
- (1) 11. The feathers on a bird's wing help him to fly because  
they 1. make a wide, light surface 2. keep the air  
off his body 3. keep the wings from cooling off too  
fast.
- (2) 12. A country should have many railroads, because 1.  
they decrease the price of food materials 2. they  
make it easy to travel and carry goods 3. they are  
good for the steel business.
- (2) 13. Why should a married man have his life insured? Be-  
cause 1. death may come at any time 2. insurance  
companies are usually honest 3. his family will not  
then suffer if he dies.
- (1) 14. Why do inventors patent their inventions? Because  
1. it gives them control of their inventions 2. it  
creates a greater demand 3. it is the custom to get  
patents.

## TEST 3 (continued)

- ( / ) 15. Why is wheat better food than corn? Because 1. it is more nutritious 2. it is more expensive 3. it can be ground finer.
- ( / ) 16. Why are electrical engineers highly paid? Because their ability is much in demand 2. they have a college education 3. they work long hours.
- ( / ) 17. Why is winter colder than summer? Because 1. the sun shines obliquely upon us in winter 2. January is a cold month 3. there is much snow in winter.
- ( 2 ) 18. We see no stars at noon because 1. they have moved around to the other side of the earth 2. they are so much fainter than the sun 3. they are hidden behind the sky.
- ( 3 ) 19. Why do some men who could afford to own a house live in a rented one? Because 1. they don't have to pay taxes 2. they don't have to buy a rented house 3. they can make more by investing the money the house would cost.
- ( 2 ) 20. Glass insulators are used to fasten telegraph wires because 1. the glass keeps the pole from being burned 2. the glass keeps the current from escaping 3. the glass is cheap and attractive.

## TEST 4

DIRECTIONS: If the two words of a pair mean the same or nearly the same write + in the parenthesis. If they mean the opposite or nearly the opposite, write - in the parenthesis.

EXAMPLES: ( - ) 1. good - bad  
( + ) 2. little - small

- ( - ) 1. cold - hot
- ( - ) 2. minus - plus
- ( - ) 3. day - night
- ( - ) 4. cry - laugh
- ( - ) 5. similar - different
- ( + ) 6. class - group
- ( + ) 7. shy - timid

## TMST 4 (continued)

- (-) 8. defective - normal
- (+) 9. accept - take
- (-) 10. complex - simple
- (-) 11. credit - debit
- (-) 12. flat - level
- (+) 13. concave - convex
- (-) 14. lax - strict
- (-) 15. toward - from
- (-) 16. careless - anxious
- (-) 17. accumulate - dissipate
- (-) 18. dissension - harmony
- (-) 19. superfluous - essential
- (-) 20. cheerful - melancholy
- (-) 21. concede - deny
- (+) 22. furtive - sly
- (+) 23. commend - approve
- (-) 24. censure - praise
- (-) 25. adversary - colleague
- (+) 26. tease - plague
- (+) 27. decadence - decline
- (+) 28. idiot - arraign
- (+) 29. knave - villain
- (-) 30. impecunious - opulent
- (+) 31. champion - advocate
- (+) 32. plenary - complete
- (+) 33. benign - genial
- (+) 34. avarice - cupidity
- (-) 35. wax - wane

## TEST 4 (continued)

- ( - ) 36. perfunctory - meticulous
  - ( + ) 37. recant - disavow
  - ( + ) 38. lugubrious - maudlin
  - ( - ) 39. aggrandize - belittle
  - ( - ) 40. agglomerate - scatter
- 

## TEST 5

DIRECTIONS: The words A EATS COW GRASS in that order are mixed up and do not make a sentence; but they would be a sentence if put in the right order; A COW EATS GRASS. This statement is true.

The words HORSES FEATHERS HAVE ALL would make a sentence if put in the order ALL HORSES HAVE FEATHERS, but this statement is false.

Look at each of the mixed-up sentences below, and think what it would say if the words were put in the right order. Then if what the sentence would say is true, write + in the parenthesis; if false, write - in the parenthesis.

- EXAMPLES: ( + ) 1. a eats cow grass  
 ( - ) 2. horses feathers have all
- 

- ( + ) 1. lions strong are
- ( - ) 2. leg flies one have only
- ( + ) 3. months warmest are summer the
- ( - ) 4. known elephant animal an is smallest the
- ( + ) 5. leaves the trees in lose their fall
- ( - ) 6. sides every has four triangle
- ( + ) 7. seldom forever good lasts luck
- ( + ) 8. many toes fingers as men as have
- ( - ) 9. happiness source of always a orime is
- ( - ) 10. money marry always for men
- ( - ) 11. flag the English same the as is the American

## TEST 5 (continued)

- (+) 12. usually judge can we actions man his by a  
 (-) 13. are clothes all made cotton of  
 (+) 14. see are with to eyes  
 (-) 15. water and made are butter from cheese  
 (+) 16. size now of guns use are great in  
 (+) 17. battleships on seldom sails used are  
 (-) 18. a ocean cross minutes few can beat the in a  
 (+) 19. inflict men pain needless cruel sometimes  
 (+) 20. as sheets are napkins used never  
 (-) 21. employ debaters irony never  
 (-) 22. always sleeplessness clear causes a conscience  
 (-) 23. external deceptive never appearances are  
 (-) 24. forget trifling friends grievances never

## TEST 6

DIRECTIONS: Look at each row of numbers below, and on the line write the number that should come next.

EXAMPLES:	2	4	6	8	10	12	<u>14</u>
	9	8	7	6	5	4	<u>3</u>
	2	2	3	3	4	4	<u>5</u>
	1	7	2	7	3	7	<u>4</u>
1.	3	4	5	6	7	8	<u>9</u>
2.	10	15	20	25	30	35	<u>40</u>
3.	8	7	6	5	4	3	<u>2</u>
4.	3	6	9	12	15	18	<u>21</u>
5.	8	1	6	1	4	1	<u>6</u>

## TEST 6 (continued)

6.	3	7	11	15	19	23	<u>24</u>
7.	9	9	7	7	5	5	<u>5</u>
8.	1	2	4	8	16	32	<u>4</u>
9.	27	27	23	23	19	19	<u>15</u>
10.	15	16	14	17	13	18	<u>13</u>
11.	8	9	12	13	16	17	<u>20</u>
12.	16	12	15	11	14	10	<u>13</u>
13.	12	14	13	15	14	16	<u>15</u>
14.	29	28	26	23	19	14	<u>11</u>
15.	61	27	9	3	1	1/3	<u>29</u>
16.	21	18	16	13	11	8	<u>1</u>
17.	2	3	5	8	12	17	<u>23</u>
18.	20	17	15	14	11	9	<u>8</u>
19.	4	8	10	20	22	44	<u>46</u>
20.	1	4	9	16	25	36	<u>41</u>

## TEST 7

DIRECTIONS: In each case of the lines below, the first two words are related to each other in some way. See what the relation is between the first two words, and then select the numbered word which is related in the same way to the third word, and write its number in the parenthesis.

EXAMPLES: (2) 1. sky--blue;:grass-- 1. table 2. green  
3. warm 4. big

(3) 2. fish--swims;:man-- 1. paper 2. time  
3. walks 4. girl

(2) 3. day--night;:white-- 1. red 2. black  
3. clear 4. pure

(2) 1. dog--bark;:cat-- 1. chair 2. mew 3. fire 4. house

## TEST 7 (continued)

- (2) 2. father--son;;mother-- 1. aunt 2. nephew 3. daughter  
4. sister
- (1) 3. dog--puppy;;cat-- 1. kitten 2. dog 3. tiger 4. horse
- (1) 4. angels--heaven;;men-- 1. earth 2. women 3. boys  
4. Paradise
- (4) 5. heehaw--donkey;;bow-wow-- 1. hen 2. cat 3. speech  
4. dog
- (1) 6. boy--man;;lamb-- 1. sheep 2. dog 3. shepherd 4. wool
- (3) 7. legs--frog;;wings-- 1. eat 2. swim 3. bird 4. nest
- (4) 8. white--black;;good-- 1. time 2. clothes 3. mother  
4. bad
- (2) 9. add--subtract;;multiply-- 1. add 2. divide 3. arith-  
metic 4. increase
- (2) 10. go--come;;sell-- 1. leave 2. buy 3. money 4. papers
- (4) 11. sweet--sugar;;sour-- 1. sweet 2. bread 3. man  
4. vinegar
- (3) 12. peninsula--land;;bay-- 1. boats 2. pay 3. ocean  
4. Massachusetts
- (2) 13. December--Christmas;;November-- 1. month 2. Thanks-  
giving 3. December 4. early
- (4) 14. establish--begin;;abolish-- 1. slavery 2. wrong  
3. abolition 4. end
- (3) 15. light--dark;;noise-- 1. report 2. ring 3. silence  
4. sound
- (2) 16. man--arm;;tree-- 1. shrub 2. limb 3. flower 4. bark
- (2) 17. winter--summer;;cold-- 1. freeze 2. warm 3. wet  
4. January
- (1) 18. bird--song;;man-- 1. speech 2. woman 3. boy 4. work
- (2) 19. hospital--patient;;prison-- 1. cell 2. criminal  
3. bar 4. jail
- (2) 20. abundant--scarce;;cheap-- 1. buy 2. costly 3. bar-  
gain 4. nasty
- (4) 21. chew--teeth;;smell-- 1. sweet 2. stink 3. odor  
4. nose

## TEST 7 (continued)

- (3) 22. order--confusion;;peace-- 1. part 2. treaty 3. war  
4. enemy
- (3) 23. eye--head;;window-- 1. key 2. floor 3. room 4. door
- (2) 24. floor--ceiling;;ground-- 1. earth 2. sky 3. hill  
4. grass
- (2) 25. hunter--gun;;fisherman-- 1. fish 2. net 3. bold  
4. wet
- (3) 26. revolver--man;;sting-- 1. gun 2. hurt 3. bee 4. hand
- (2) 27. pan--tin;;table-- 1. chair 2. wood 3. legs 4. dishes
- (1) 28. diamond--rare;;iron-- 1. common 2. silver 3. ore  
4. steel
- (4) 29. devil--angel;;bad-- 1. mean 2. disobedient 3. defamed  
4. good
- (1) 30. food--man;;fuel-- 1. engine 2. burn 3. coal 4. wood
- (3) 31. winter--season;;January-- 1. February 2. day 3. month  
4. Christmas
- (1) 32. historian--facts;;novelist-- 1. fiction 2. Dickens  
3. writer 4. book
- (1) 33. tears--laughter;;sorrow-- 1. joy 2. distress  
3. funeral 4. sad
- (1) 34. quarrel--enemy;;agree-- 1. friend 2. disagree  
3. agreeable 4. foe
- (2) 35. imitate--invent;;copy-- 1. write 2. pencil 3. orig-  
inate 4. draw
- (2) 36. hour--day;;day-- 1. night 2. week 3. hour 4. noon
- (3) 37. tolerate--pain;;welcome-- 1. pleasure 2. unwelcome  
3. friends 4. give
- (4) 38. engineer--chauffeur;;locomotive-- 1. iron 2. stack  
3. engine 4. auto
- (2) 39. draw--picture;;make-- 1. destroy 2. table 3. break  
4. hard
- (4) 40. advice--command;;persuasion-- 1. help 2. aid  
3. urging 4. compulsion



## TEST 7 (continued)

- (3) 22. order--confusion;;peace-- 1. part 2. treaty 3. war  
4. enemy
- (3) 23. eye--head;;window-- 1. key 2. floor 3. room 4. door
- (2) 24. floor--ceiling;;ground-- 1. earth 2. sky 3. hill  
4. grass
- (2) 25. hunter--gun;;fisherman-- 1. fish 2. net 3. bold  
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- (4) 38. engineer--chauffeur;;locomotive-- 1. iron 2. stack  
3. engine 4. auto
- (3) 39. draw--picture;;make-- 1. destroy 2. table 3. break  
4. hard
- (4) 40. advice--command;;persuasion-- 1. help 2. aid  
3. urging 4. compulsion

## TEST 8

DIRECTIONS; In each of the sentences below you have four choices for the last word. Choose the one which makes the truest sentence, and write the number of that word in the parenthesis.

EXAMPLE; (2) People hear with the 1. eyes 2. ears  
3. nose 4. mouth

The correct answer is ears, so 2 is written in the parenthesis.

- 
- ( / ) 1. Alfalfa is a kind of 1. hay 2. corn 3. fruit 4. rice
- ( / ) 2. The most prominent industry of Detroit is 1. automobiles 2. brewing 3. flour 4. packing
- ( 2 ) 3. The Percheron is a kind of 1. goat 2. horse 3. cow 4. sheep
- ( / ) 4. Diamonds are obtained from 1. mines 2. reefs 3. elephants 4. oysters
- ( 2 ) 5. Habess corpus is a term used in 1. medicine 2. law 3. theology 4. pedagogy
- ( 2 ) 6. The mimeograph is a kind of 1. typewriter 2. copying machine 3. phonograph 4. pencil
- ( / ) 7. The clarinet is used in 1. music 2. stenography 3. book-binding 4. lithography
- ( 3 ) 8. Denim is a 1. dance 2. food 3. fabric 4. drink
- ( 2 ) 9. Air and gasoline are mixed in the 1. accelerator 2. carburetor 3. transmission 4. differential
- ( 4 ) 10. Marie Curie was a 1. singer 2. writer 3. actress 4. scientist
- ( 2 ) 11. The Wyandotte is a kind of 1. horse 2. fowl 3. cattle 4. granite
- ( 2 ) 12. Pinochle is played with 1. rackets 2. cards 3. pins 4. dice
- ( / ) 13. The penguin is a 1. bird 2. fish 3. reptile 4. insect
- ( / ) 14. Newton was most famous in 1. science 2. politics 3. literature 4. war
- ( 3 ) 15. An aspen is a 1. machine 2. fabric 3. tree 4. drink

## TEST 8 (continued)

- (3) 16. Calcutta is a city in 1. Egypt 2. China 3. India  
4. Japan
- (2) 17. The sabre is a kind of 1. musket 2. sword 3. cannon  
4. pistol
- (3) 18. Artichoke is a kind of 1. hay 2. corn 3. vegetable  
4. fodder
- (1) 19. The clavicle is in the 1. shoulder 2. head 3. abdomen  
4. neck
- (4) 20. John Wesley was most famous in 1. literature 2. sci-  
ence 3. war 4. religion
- (2) 21. Emeralds are usually 1. red 2. green 3. blue 4. yel-  
low
- (3) 22. The Battle of Lexington was fought in 1. 1620 2. 1775  
3. 1812 4. 1864
- (3) 23. Darwin was most famous in 1. literature 2. science  
3. war 4. politics
- (2) 24. The rutabaga is a 1. lizard 2. vegetable 3. fish  
4. snake
- (4) 25. Bile is made in the 1. spleen 2. kidneys 3. stomach  
4. liver
- (3) 26. Chard is a 1. fish 2. lizard 3. vegetable 4. snake
- (3) 27. An irregular four-sided figure is called a 1. scho-  
lium 2. triangle 3. trapezium 4. pentagon
- (1) 28. Becky Sharp appears in 1. Vanity Fair 2. Romola  
3. The Christmas Carol 4. Henry IV
- (3) 29. The U. S. Naval Academy is at 1. West Point 2. Annap-  
olis 3. New Haven 4. Ithaca.
- (4) 30. Rio Janeiro is a city of 1. Spain 2. Argentina  
3. Portugal 4. Brazil
- (1) 31. The number of a Korean's legs is 1. two 2. four  
3. six 4. eight
- (3) 32. The ohm is used in measuring 1. rainfall 2. wind  
power 3. electricity 4. water power
- (2) 33. Slice is a term used in 1. bowling 2. golf 3. tennis  
4. football
- ( ) 34. Cerise is a 1. color 2. drink 3. fabric 4. food

## TEST 8 (continued)

- ( / ) 35. Yale University is at 1. New Haven 2. Annapolis  
3. Ithaca 4. Cambridge
- ( / ) 36. The author of "The Scarlet Letter" is 1. Hawthorne  
2. Poe 3. Stevenson 4. Kipling
- ( 2 ) 37. Rosa Bonheur is famous as a 1. poet 2. painter  
3. composer 4. sculptor
- ( / ) 38. A tedder is used in 1. farming 2. fishing 3. hunting  
4. athletics
- ( 4 ) 39. Falstaff appears in 1. Romeo 2. Vanity Fair  
3. Oliver Twist 4. Henry IV
- ( 2 ) 40. Napoleon defeated the Austrians at 1. Friedland  
2. Wagram 3. Waterloo 4. Leipzig

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FORM B

TEST 1\*

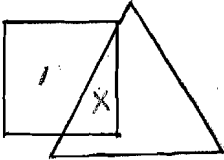


1. Make a figure 2 in the second circle and also a cross in the third circle.



2. Draw a line from Circle 1 to Circle 4 that will pass below Circle 2 and above Circle 3.

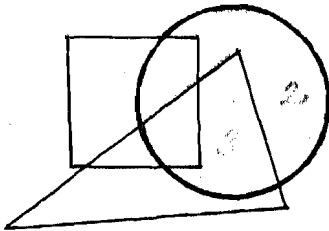
3-4



3. Make a figure 1 in the space which is in the square but not in the triangle.

4. Make a cross in the space which is in the triangle and the square.

5-6



5. Make a figure 2 in the space which is in the circle, but not in the triangle or square.

6. Make a figure 3 in the space which is in the triangle and circle, but not in the square.

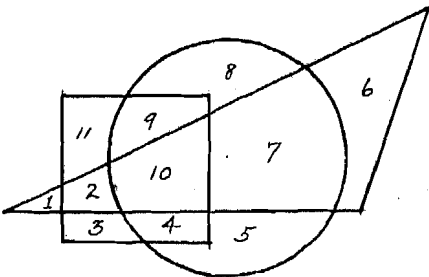
7. Print the last letter of the word which is the opposite of hot . . . . . (D)

8. If 7 is more than 5, write the number 6, unless 6 is more than 8, in which case write the number 5 . . . . . (6)

9. What number is in the space which is in the square and triangle but not in the circle? . . . . . (5)

10. What number is in the same pair of geometrical figures as the number 9? . . . . . (4)











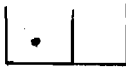






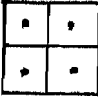






11. How many spaces are there that are in two and only two geometrical figures? . . . . . (2)



12. In a foreign language, sile tano means small table, and mire tano means small dog. Print the first letter of the foreign word for dog . . . . . (M)

\* For directions, see Form A.

## TEST 1 (continued)

13.  is to  as  is to:
1.  2.  3.  . . . . ( 2 )
14.  is to  as  is to:
1.  2.  3.  . . . . ( 3 )
15.  is to  as  is to:
1.  2.  3.  . . . . ( 1 )
16.  is to  as  is to:
1.  2.  3.  . . . . ( 2 )

## TEST 2

1. How many are 20 boats and 9 boats? . . . . . ( 29 )
2. If you save \$4 a month for 9 months, how much will you save? . . . . . ( 36 )
3. A train moved forward 6 miles and backed 2 miles. How far was it from the first position? . . . . . ( 4 )
4. If 48 men are divided into teams of 8, how many teams will there be? . . . . . ( 6 )
5. How many hours will it take a truck to go 48 miles at the rate of 3 miles an hour? . . . . . ( 16 )
6. Mike had 11 cigars. He bought 3 more and then smoked 8, How many cigars did he have left? . . . . . ( 6 )
7. How many cigars can you buy for \$1.00 at the rate of 2 for 5 cents? . . . . . ( 40 )
8. A rectangular bin holds 500 cubic feet of lime. If the bin is 10 feet long and 5 feet deep, how wide is it? . . . . . ( 10 )

## TEST 2 (continued)

9. A submarine goes 6 miles an hour under water and 20 miles an hour on the surface. How long will it take to cross a 100-mile channel, if it has to go three-fifths of the way under water? . . . . . ( 12 )
10. A dealer bought some mules for \$1,200. He sold them for \$1,500, making \$50 on each mule. How many mules were there? . . . . . ( 6 )
11. If 214 squads of men are to dig 5,992 yards of trench, how many yards must be dug by each squad? . . . . . ( 28 )
12. If you buy 2 packages of tobacco at 7 cents each and a pipe for 75 cents, how much change should you get from a two-dollar bill? . . . . . ( 1.10 )
13. If  $5\frac{1}{2}$  tons of bark cost \$33, what will  $3\frac{1}{2}$  tons cost? . . . . . ( 21 )
14. A regiment marched 40 miles in five days. The first day they marched 9 miles, the second day six miles, the third 10 miles, the fourth 7 miles. How many miles did they march the last day? . . . . . ( 8 )
15. If it takes 5 men 4 days to dig a 200-foot drain, how many men are needed to dig it in half a day? . . . . . ( 40 )
16. A ship has provisions to last her crew of 400 men 6 months. How long would it last 1,600 men? . . . . . ( 1 1/2 )
17. A recruit spent one-eighth of his spare change for post cards and twice as much for a box of letter paper, and then had \$2.00 left. How much money did he have at first? . . . . . ( 3.20 )
18. A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the remainder of its stock to 38 mess halls. Of this remainder each mess hall received 45 barrels. What was the total number of barrels supplied? . . . . . ( 307 )
19. If an airplane goes 300 yards in 10 seconds, how many feet does it go in a fifth of a second? . . . . . ( 12 )
20. A certain division contains 6,000 artillery, 15,000 infantry, and 1,000 cavalry. If each branch is expanded proportionately until there are in all 24,200 men, how many will be added to the artillery? . . . . . ( 60 )

## TEST 3

- ( / ) 1. If plants are dying for lack of rain, you should  
1. water them 2. ask a florist's advice 3. put  
fertilizer around them
- ( 2 ) 2. If the grocer should give you too much money in  
making change, what is the right thing to do?  
1. buy some candy of him with it 2. give it to the  
first poor man you meet 3. tell him of his mistake
- ( 2 ) 3. If you are lost in a forest in the daytime, what is  
the thing to do? 1. hurry to the nearest house you  
know of 2. look for something to eat 3. use the  
sun or a compass for a guide
- ( 2 ) 4. If you find a man who has hanged himself, you should  
1. send a notice to the paper 2. take him home 3. call  
a doctor or the police
- ( 2 ) 5. Why is beef better food than cabbage? Because 1. it  
tastes better 2. it is more nourishing 3. it is hard-  
er to obtain
- ( 2 ) 6. Theaters are useful institutions because 1. they em-  
ploy actors 2. they afford a method of relaxation  
3. they give the rich a chance to spend their money
- ( / ) 7. Why should food be chewed before swallowing? 1. it  
is better for the health 2. it is bad manners to  
swallow without chewing 3. chewing keeps the teeth  
in condition
- ( / ) 8. Why should all parents be made to send their children  
to school? Because 1. it prepares them for adult  
life 2. it keeps them out of mischief 3. they are  
too young to work
- ( 2 ) 9. Freezing water bursts pipes because 1. cold makes  
the pipes weaker 2. water expands when it freezes  
3. the ice stops the flow of water
- ( / ) 10. Some men lose their breath on high mountains because  
1. the wind blows their breath away 2. the air is  
too rare 3. it is always cold there
- ( / ) 11. Why are doctors useful? Because they 1. understand  
human nature 2. always have pleasant dispositions  
3. know more about diseases than others
- ( / ) 12. Why do some people think that short men should be  
admitted to the army? Because 1. usefulness does  
not depend upon height 2. they want to enlist  
3. they are more intelligent than tall men



## TEST 3 (continued)

- ( 2 ) 13. Thermometers are useful, because 1. they regulate the temperature 2. they tell us how warm it is 3. they contain mercury
- ( 3 ) 14. Why is a check better than real money? Because checks are cleaner than bills 2. you can have all the money you need by writing checks 3. checks are safer and more convenient
- ( 3 ) 15. Why is New York larger than Boston? Because 1. it has more railroads 2. it has more millionaires 3. it is better located
- ( 3 ) 16. Gold is more valuable than iron for making money because 1. gold is pretty 2. iron rusts easily 3. gold is scarcer and more valuable
- ( 2 ) 17. If your load of coal gets stuck in the mud, what should you do? 1. leave it there 2. get more horses and men to pull it out 3. throw off the load
- ( 3 ) 18. Why are high mountains covered with snow? Because 1. they are near the clouds 2. the sun seldom shines on them 3. the air is cold there
- ( 3 ) 19. Electric lights are better than gas lights because electricity 1. makes a white light 2. is safer and more convenient 3. is cheaper
- ( 3 ) 20. In Leap Year February has 29 days because 1. February is a short month 2. some people are born on 29th 3. otherwise the calendar would not come out right

## TEST 4

- ( - ) 1. no - yes
- ( - ) 2. danger - safety
- ( - ) 3. bitter - sweet
- ( + ) 4. genuine - real
- ( - ) 5. masculine - feminine
- ( / ) 6. joy - happiness
- ( + ) 7. slim - slender
- ( / ) 8. bare - naked

## TEST 4 (continued)

- (+) 9. recoup - recover
- (+) 10. linger - loiter
- (-) 11. sacred - profane
- (+) 12. comfort - console
- (+) 13. crude - coarse
- (+) 14. diligent - industrious
- (-) 15. irksome - refreshing
- (-) 16. agony - bliss
- (+) 17. deplete - exhaust
- (+) 18. agitate - excite
- (-) 19. contradict - confirm
- (+) 20. null - void
- (-) 21. momentous - immaterial
- (-) 22. myopia - hyperopia
- (+) 23. avert - prevent
- (+) 24. asunder - apart
- (+) 25. hoax - deception
- (+) 26. amenable - tractable
- (-) 27. contradict - corroborate
- (+) 28. proclivity - inclination
- (-) 29. altruistic - egotistic
- (+) 30. latent - hidden
- (+) 31. dearth - scarcity
- (+) 32. contingent - dependent
- (-) 33. convoke - dismiss
- (+) 34. cleave - split
- (-) 35. suavity - asperity

## TEST 4 (continued)

- (+) 36. palliate - mitigate
  - (+) 37. lucrative - profitable
  - (-) 38. preamble - peroration
  - (+) 39. abstruse - recondite
  - (+) 40. ambiguous - equivocal
- 

## TEST 5

- (+) 1. cows milk give
- (+) 2. east the in rises sun the
- (-) 3. and cows from honey come bread
- (+) 4. earth is mined coal the from
- (-) 5. wood eat and good to are coal
- (-) 6. harness paper of made is
- (-) 7. Washington canal 1776 Panama the in built
- (-) 8. are and apples long thin
- (-) 9. place pole is north comfortable a the
- (+) 10. hump camel has a his a back on
- (+) 11. young nurse their cats
- (-) 12. grow and apples ground oranges the in
- (+) 13. write are with to pencils
- (+) 14. property floods life and destroy
- (+) 15. tools valuable is for sharp making steel
- (-) 16. men misfortune have good never
- (+) 17. repeated call human for courtesies associations
- (-) 18. temperatures freezes water high at
- (+) 19. seen can the moon nights not be some
- (+) 20. judges just all be to ought

## TEST 5 (continued)

- (+) 21. and emotions sorrow similar grief are  
 (-) 22. happiness lists great casualty cause  
 (-) 23. brings avarice man friends a  
 (-) 24. cardinal not cultivated virtues the he should
- 

## TEST 6

1.	2	3	4	5	6	7	<u>8</u>
2.	5	10	15	20	25	30	<u>35</u>
3.	10	9	8	7	6	5	<u>4</u>
4.	6	9	12	15	18	21	<u>24</u>
5.	5	9	13	17	21	25	<u>29</u>
6.	9	1	7	1	5	1	<u>3</u>
7.	6	8	6	6	4	4	<u>2</u>
8.	1	2	4	8	16	32	<u>64</u>
9.	25	25	21	21	17	17	<u>13</u>
10.	16	8	4	2	1	$\frac{1}{2}$	<u><math>\frac{1}{4}</math></u>
11.	16	17	15	18	14	19	<u>13</u>
12.	8	9	12	13	16	17	<u>20</u>
13.	18	14	17	13	16	12	<u>15</u>
14.	11	13	12	14	13	15	<u>14</u>
15.	25	24	22	21	19	18	<u>16</u>
16.	3	4	6	9	13	18	<u>24</u>
17.	19	16	14	11	9	6	<u>4</u>
18.	3	6	8	16	18	36	<u>54</u>
19.	21	18	16	15	12	10	<u>9</u>
20.	1	4	9	16	25	36	<u>49</u>

## TMST 7

- (2) 1. bird--sings;;dog-- 1. fire 2. barks 3. snow 4. flag
- (1) 2. eat--bread;;drink-- 1. water 2 iron 3. lead  
4. stones
- (1) 3. wrist--bracelet;;neck-- 1. collar 2. leg 3. foot  
4 giraffe
- (3) 4. finger--hand;;toe-- 1. box 2. foot 3. doll 4. coat
- (3) 5. tiger--wild;;cat-- 1. dog 2. mouse 3. tame 4. pig
- (2) 6. suitcase--clothing;;purse-- 1. purchase 2. money  
3. string 4. stolen
- (3) 7. blonde--brunette;;light-- 1. house 2 electricity  
3. dark 4. girl
- (4) 8. roof--house;;hat-- 1. button 2. shoe 3. straw 4. head
- (1) 9. skirts--girl;;trousers-- 1. boy 2. hat 3. vest  
4. coat
- (3) 10. cellar--attic;;bottom-- 1. well 2. tub 3. top  
4. house
- (4) 11. yes--no;;affirmative-- 1. win 2. debate 3. deny  
4. negative
- (1) 12. straw--hat;;leather-- 1. shoe 2. bark 3. coat  
4. soft
- (1) 13. Edison--phonograph;;Columbus-- 1. America 2. Wash-  
ington 3. Spain 4. Ohio
- (2) 14. cannon--large;;rifle-- 1. ball 2. small 3. bore  
4. shoot
- (4) 15. love--hatred;;friend-- 1. lover 2. mother 3. need  
4. enemy
- (3) 16. granary--wheat;;library-- 1. desk 2. books 3. paper  
4. librarian
- (2) 17. 10--100;;1000-- 1. money 2. 10000 3. 20000 4. wealth
- (1) 18. success--joy;;failure-- 1. sadness 2. success  
3. fail 4. work
- (1) 19. education--ignorance;;wealth-- 1. poverty 2. riches  
3. health 4. comfort
- (2) 20. esteem--despise;;friends-- 1. Quakers 2. enemies  
3. lovers 4. men

## TEST 7 (continued)

- ( / ) 21. Monday--Tuesday;:Friday-- 1. week 2. Thursday 3. day  
4. Saturday
- ( 2 ) 22. Washington--Adams;:first-- 1. contrast 2. best  
3. second 4. last
- ( / ) 23. clothes--man;:hair-- 1. horse 2. comb 3. heard  
4. hat
- ( 3 ) 24. hat--head;:thimble-- 1. sew 2. cloth 3. finger  
4. hand
- ( / ) 25. whale--large;:thunder-- 1. loud 2. rain 3. light-  
ning 4. kill
- ( 3 ) 26. poison--death;:food-- 1. eat 2. bird 3. life 4. bad
- ( / ) 27. book--writer;:status-- 1. sculptor 2. liberty  
3. picture 4. state
- ( 3 ) 28. establish--abolish;:begin-- 1. work 2. year 3. end  
4. commence
- ( 3 ) 29. egg--bird;:seed-- 1. grow 2. plant 3. crack 4. ger-  
minate
- ( / ) 30. palace--king;:hut-- 1. peasant 2. cottage 3. farm  
4. city
- ( 2 ) 31. door--house;:gate-- 1. swing 2. hinges 3. yard  
4. latch
- ( 2 ) 32. legs--man;:wheels-- 1. spokes 2. carriage 3. go  
4. tire
- ( 2 ) 33. writer--books;:bee-- 1. hive 2. honey 3. wasp  
4. sting
- ( 2 ) 34. horse--mule;:obedient-- 1. disgraceful 2. donkey  
3. stubborn 4. obey
- ( / ) 35. Caucasian--English;:Mongolian-- 1. Chinese 2. Indi-  
an 3. negro 4. yellow
- ( 3 ) 36. cloud-burst--shower;:cyclone-- 1. bath 2. breeze  
3. destroy 4. West
- ( 2 ) 37. prosperity--happiness;:adversity-- 1. success  
2. sorrow 3. fun 4. rage
- ( 3 ) 38. sand--glass;:clay-- 1. stone 2. hay 3. bricks  
4. dirt

## TEST 7 (continued)

- (3) 39. behind--late;;before-- 1. after 2. soon 3. early  
4. dinner
- (1) 40. arteries--body;;railroads-- 1. country 2. train  
3. crossing 4. accident
- 

## TEST 8

- (3) 1. Rubber is obtained from 1. ore 2. petroleum 3. trees  
4. hides
- (4) 2. The Rhode Island Red is a kind of 1. horse 2. granite  
3. cattle 4. fowl
- (3) 3. The forward pass is used in 1. tennis 2. hockey  
3. football 4. golf
- (1) 4. The Holstein is a kind of 1. cow 2. horse 3. sheep  
4. goat
- (4) 5. The watt is used in measuring 1. wind power 2. rain-  
fall 3. water power 4. electricity
- (2) 6. The author of Huckleberry Finn is 1. Poe 2. Mark  
Twain 3. Stevenson 4. Hawthorne
- (2) 7. Jane Addams is known as a 1. singer 2. social worker  
3. actress 4. scientist
- (4) 8. Pearls are obtained from 1. mines 2. elephants  
3. reefs 4. oysters
- (2) 9. Scrooge appears in 1. Vanity Fair 2. The Christmas  
Carol 3. Romola 4. Henry IV
- (4) 10. Maroon is a 1. food 2. fabric 3. drink 4. color
- (4) 11. Pasteur is most famous in 1. politics 2. literature  
3. war 4. science
- (2) 12. A five-sided figure is called a 1. scholium 2. pen-  
tagon 3. parallelogram 4. trapezium
- (3) 13. The U. S. School for Army Officers is at 1. Annap-  
olis 2. West Point 3. New Haven 4. Ithaca
- (4) 14. Portia is in 1. Vanity Fair 2. Romola 3. The  
Christmas Carol 4. The Merchant of Venice
- (1) 15. The most prominent industry of Gloucester is 1. fish-  
ing 2. packing 3. brewing 4. automobiles

## TEST 8 (continued)

- ( 1 ) 16. The artichoke is a 1. vegetable 2. fish 3. lizard  
4. snake
- ( 2 ) 17. General Lee surrendered at Appomattox in 1. 1812  
2. 1865 3. 1886 4. 1888
- ( 1 ) 18. The cutlass is a kind of 1. sword 2. musket 3. canon  
4. pistol
- ( 3 ) 19. The dictaphone is a kind of 1. typewriter 2. multi-  
graph 3. phonograph 4. adding machine
- ( 2 ) 20. The xylophone is used in 1. lithography 2. music  
3. stenography 4. book-binding
- ( 2 ) 21. The thyroid is in the 1. shoulder 2. neck 3. head  
4. abdomen
- ( 4 ) 22. Timothy is a kind of 1. corn 2. rye 3. wheat 4. hay
- ( 4 ) 23. Salsify is a kind of 1. snake 2. fish 3. lizard  
4. vegetable
- ( 3 ) 24. Cypress is a kind of 1. machine 2. food 3. tree  
4. fabric
- ( 4 ) 25. Tokio is a city of 1. India 2. China 3. Egypt  
4. Japan
- ( 1 ) 26. Maize is a kind of 1. corn 2. hay 3. oats 4. rice
- ( 2 ) 27. Homicide is a term used in 1. medicine 2. law 3. the-  
ology 4. pedagogy
- ( 2 ) 28. Harvard University is in 1. Annapolis 2. Cambridge  
3. Ithaca 4. New Haven
- ( 1 ) 29. The number of a Hottentot's legs is 1. two 2. four  
3. six 4. eight
- ( 2 ) 30. The armadillo is a kind of 1. ornamental shrub  
2. animal 3. musical instrument 4. dagger
- ( 3 ) 31. Diesel engines are driven by 1. alcohol 2. elec-  
tricity 3. fuel oil 4. gasoline
- ( 3 ) 32. Kelvin was most famous in 1. politics 2. war  
3. science 4. literature
- ( 3 ) 33. Rodin is famous as a 1. poet 2. painter 3. sculptor  
4. composer
- ( 4 ) 34. Buenos Aires is a city of 1. Spain 2. Brazil 3. Por-  
tugal 4. Argentina



## TEST 8 (continued)

- (4) 35. Faraday was most famous in 1. literature 2. war  
3. religion 4. science
- (14) 36. Garnets are usually 1. yellow 2. blue 3. green  
4. red
- (3) 37. Euchre is played with 1. dice 2. rackets 3. cards  
4. pins
- (2) 38. Madras is a 1. drink 2. fabric 3. food 4. dance
- (3) 39. Henry VIII's wives numbered 1. four 2. five 3. six  
4. seven 5. eight 6. nine
- (3) 40. Ensilage is a term used in 1. fishing 2. athletics  
3. farming 4. hunting

FORM C

TEST 1\*

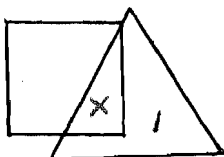


1. Make a figure 1 in the first circle and also a cross in the third circle.



2. Draw a line from Circle 2 to Circle 5 that will pass above Circle 3 and below Circle 4.

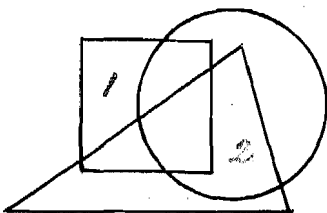
3-4



3. Make a figure 1 in the space which is in the triangle but not in the square.

4. Make a cross in the space which is in the triangle and in the square.

5-6



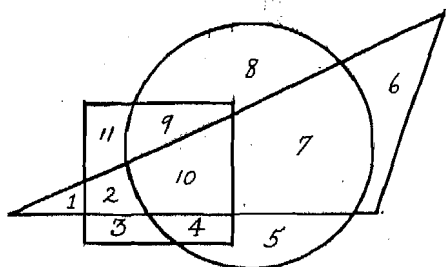
5. Make a figure 1 in the space which is in the square, but not in the circle or triangle.

6. Make a figure 2 in the space which is in the circle and triangle, but not in the square.

7. Print the last letter of the word which is the opposite of black . . . . . (E)

8. If 6 is more than 4, write the number 5, unless 5 is more than 7, in which case write the number 6 . . . (5)

9. What number is in the space which is in the triangle and circle but not in the square? . . . . . (7)















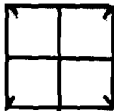

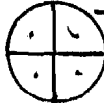
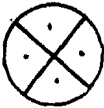

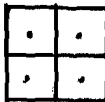






10. What number is in the same pair of geometrical figures as the number 9? . . . . . (4)

11. How many spaces are there that are in two and only two geometrical figures? . . . . . (4)

12. In a foreign language, sile dola means large table, and mire dola means large dog. Print the first letter of the foreign word for large . . . . . (D)

\* For directions, see Form A.

## TEST 1 (continued)

13.  is to  as  is to:
1.  2.  3.  . . . . (3)
14.  is to  as  is to:
1.  2.  3.  . . . . (3)
15.  is to  as  is to:
1.  2.  3.  . . . . (1)
16.  is to  as  is to:
1.  2.  3.  . . (2)

## TEST 2

1. How many are 40 tents and 6 tents? . . . . (46)
2. If you save \$7 a month for 4 months, how much will you save? . . . . (28)
3. A train moved forward 5 miles and backed 3 miles. How far was it then from its first position? . . . . (2)
4. If 40 men are divided into teams of 8, how many teams will there be? . . . . (5)
5. Mike had 12 cigars. He bought 2 more and then smoked 7. How many cigars did he have left? . . . . (7)
6. How many pencils can you buy for 40 cents at the rate of 2 for 5 cents? . . . . (16)
7. A dealer bought some mules for \$900. He sold them for \$1,000, making \$25 on each mule. How many mules were there? . . . . (4)

## TEST 2 (continued)

8. A regiment marched 40 miles in five days. The first day they marched 9 miles, the second day 6 miles, the third 10 miles, the fourth 8 miles. How many miles did they march the last day? . . . . . ( 7 )
9. How many hours will it take a truck to go 42 miles at the rate of 3 miles an hour? . . . . . ( 14 )
10. If  $3\frac{1}{2}$  tons of coal cost \$21, what will  $5\frac{1}{2}$  tons cost? . . . . . ( 35 )
11. If 241 squads of men are to dig 4,097 yards of trench, how many yards must be dug by each squad? . ( 17 )
12. A rectangular bin holds 400 cubic feet of lime. If the bin is 10 feet long and 4 feet wide, how deep is it? . . . . . ( 8 )
13. If you buy 2 packages of tobacco at 8 cents each and a pipe for 55 cents, how much change should you get from a two-dollar bill? . . . . . ( 1.27 )
14. A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the remainder of its stock to 28 mess halls. Of this remainder each mess hall received 47 barrels. What was the total number of barrels supplied? . . . . . ( 2243 )
15. If a man runs a hundred yards in 10 seconds, how many feet does he run in a fifth of a second? . . ( 6 )
16. A submarine makes 10 miles an hour under water and 20 miles on the surface. How long will it take to cross a 100-mile channel, if it has to go three-fifths of the way under water? . . . . . ( 7 )
17. If it takes 4 men 3 days to dig a 120-foot drain, how many men are needed to dig it in half a day? . ( 24 )
18. A recruit spent one-eighth of his spare change for post cards and twice as much for a box of letter paper, and then had \$1.00 left. How much money did he have at first? . . . . . ( 1.60 )
19. A certain division contains 5,000 artillery, 15,000 infantry, and 1,000 cavalry. If each branch is expanded proportionately until there are in all 23100 men, how many will be added to the artillery? . . . ( 1000 )
20. A ship has provisions to last her crew of 600 men 6 months. How long would it last 800 men? . . . . ( 4.5 )

## TEST 3

- (2) 1. Why is leather used for shoes? Because 1. it is produced in all countries 2. it wears well 3. it is an animal product
- (5) 2. If you were asked what you thought of a person whom you didn't know, what would you say? 1. I will go and get acquainted. 2. I think he is all right 3. I I don't know him and can't say.
- (3) 3. If a man made a million dollars, he ought to 1. pay off the national debt 2. contribute to various worthy charities 3. give it all to some poor man
- (1) 4. Why do inventors patent their inventions? Because 1. it gives them control of their inventions 2. it creates a greater demand 3. it is the custom to get patents
- (3) 5. The main thing the farmers do is to 1. supply luxuries 2. make work for the unemployed 3. feed the nation
- (2) 6. A machine gun is more deadly than a rifle, because 1. it was invented more recently 2. fires more rapidly 3. can be used with less training
- (2) 7. Why are pencils more commonly carried than fountain pens? Because 1. they are more brightly colored 2. they are cheaper 3. they are not so heavy
- (1) 8. Five P. M. is the rush hour upon street cars because 1. working people are going home at that hour 2. so many people live in the suburbs 3. street cars are the best cheap means of transportation
- (1) 9. Why are criminals locked up? 1. to protect society 2. to get even with them 3. to make them work
- (5) 10. If you find a lost 2-year-old baby on a city street, what should you do? 1. ask him where he lives and take him there 2. if he is a nice child take him home and keep him 3. ask the police to help you or leave him with them
- (3) 11. You should not give money to beggars on the street because 1. it makes it hard for the beggars to get work 2. it takes away the work of organized charities 3. it encourages living off others
- (3) 12. Why do soldiers wear wrist watches rather than pocket watches? Because 1. they keep better time 2. they are harder to break 3. they are handier

## TEST 3 (continued)

- (2) 13. A house is better than a tent, because 1. it costs more 2. it is more comfortable 3. it is made of wood
- (2) 14. If it rains when you are starting to go for the doctor, what should you do? 1. stay at home 2. take an umbrella 3. wait until it stops raining
- (2) 15. A train is harder to stop than an automobile because 1. it is longer 2. it is heavier 3. the brakes are not so good
- (2) 16. Why is wool better than cotton for making sweaters? Because 1. wool is cheaper 2. it is warmer 3. it wears longer
- (7) 17. If you are hurrying in an auto to catch a train and come to a broken bridge, what should you do? 1. go around and try another road 2. take off your clothes and swim across 3. hire a horse and ride across
- (3) 18. If the earth were nearer the sun 1. the stars would disappear 2. our months would be longer 3. the earth would be warmer
- (2) 19. Why do some men who could afford to own a house live in a rented one? Because 1. they don't have to pay taxes 2. they don't have to buy a rented house 3. they can make more by investing the money the house would cost
- (2) 20. Glass insulators are used to fasten telegraph wires because 1. the glass keeps the pole from being burned 2. the glass keeps the current from escaping 3. the glass is cheap and attractive

## TEST 4

- (- ) 1. slow - fast
- (+ ) 2. choose - select
- (- ) 3. ancient - modern
- (- ) 4. long - short
- (- ) 5. con - pro
- (- ) 6. asleep - awake
- (- ) 7. waste - conserve

## TEST 4 (continued)

- (+) 8. assume - suppose
- (+) 9. begin - commence
- (+) 10. allure - attract
- (+) 11. shrill - sharp
- (-) 12. cautious - heedless
- (-) 13. carnivorous - herbivorous
- (+) 14. go - leave
- (-) 15. fault - virtue
- (+) 16. jealousy - envy
- (+) 17. bestow - confer
- (-) 18. recline - stand
- (+) 19. conquer - subdue
- (-) 20. besmirch - cleanse
- (-) 21. celestial - terrestrial
- (+) 22. repress - restrain
- (+) 23. eminent - distinguished
- (+) 24. conspicuous - prominent
- (-) 25. debase - exalt
- (+) 26. beg - entreat
- (+) 27. pertinacious - obstinate
- (+) 28. degenerate - deteriorate
- (-) 29. sterile - fertile
- (-) 30. choleric - phlegmatic
- (-) 31. docile - refractory
- (+) 32. urbanity - civility
- (+) 33. finite - limited
- (+) 34. vestige - trace

## TEST 4 (continued)

- (+) 35. supercilious - disdainful
  - (+) 36. execrate - revile
  - (+) 37. node - knot
  - (+) 38. orifice - aperture
  - (-) 39. prefix - append
  - (+) 40. reverence - veneration
- 

## TEST 5

- (+) 1. iron heavy is
- (+) 2. chairs sit are to on
- (-) 3. Alaska in cotton grows
- (-) 4. happy is man sick always a
- (-) 5. pole north equator mile one from is the the
- (+) 6. fuel wood are coal and for used
- (+) 7. trees in nests build birds
- (+) 8. live dangerous is near a volcano to it
- (+) 9. sounds people some loud annoy
- (-) 10. sand of made bread powder and is
- (+) 11. always is not a a stenographer bookkeeper
- (+) 12. due sometimes calamities are accident to
- (+) 13. certain some death of mean kinds sickness
- (+) 14. not eat gunpowder to good is
- (-) 15. bad are shots soldiers all
- (-) 16. sails is steamboat usually propelled a
- (+) 17. will live bird no forever
- (+) 18. horses automobile an are than slower



## TEST 5 (continued)

- (+) 19. people enemies arrogant many make  
 (-) 20. love we wrong those us always who  
 (+) 21. food is tobacco as valuable a not  
 (-) 22. never deeds rewarded be should good  
 (-) 23. never man the show the deeds  
 (+) 24. made cloth wool cotton and is from

## TEST 6

1.	3	4	5	6	7	8	<u>9</u>
2.	5	10	15	20	25	30	<u>25</u>
3.	10	9	8	7	6	5	<u>4</u>
4.	3	6	9	12	15	18	<u>21</u>
5.	5	9	13	17	21	25	<u>27</u>
6.	8	1	6	1	4	1	<u>2</u>
7.	9	9	7	7	5	5	<u>2</u>
8.	1	2	4	8	16	32	<u>64</u>
9.	27	27	23	23	19	19	<u>15</u>
10.	16	8	4	2	1	$\frac{1}{2}$	<u><math>\frac{1}{4}</math></u>
11.	15	16	14	17	13	18	<u>12</u>
12.	8	9	12	13	16	17	<u>20</u>
13.	16	12	15	11	14	10	<u>13</u>
14.	11	13	12	14	13	15	<u>14</u>
15.	29	28	26	23	19	14	<u>11</u>
16.	3	4	6	9	13	18	<u>24</u>
17.	19	16	14	11	9	6	<u>4</u>
18.	3	6	8	16	18	36	<u>27</u>

## TEST 6 (continued)

19.	20	17	15	14	11	9	<u>    </u>
20.	1	4	9	16	25	36	<u>    </u>

---

## TEST 7

- (3) 1. pup--dog;;lamb-- 1. red 2. door 3. sheep 4. book
- (3) 2. lion--roar;;dog-- 1. drive 2. pony 3. bark 4. harness
- (2) 3. Japanese--Japan;;Chinese-- 1. Russia 2. China 3. Japanese 4. pigtail
- (3) 4. sit--chair;;sleep-- 1. book 2. tree 3. bed 4. see
- (3) 5. north--south;;east-- 1. north 2. west 3. south 4. east
- (2) 6. granary--wheat;;library-- 1. read 2. books 3. paper 4. chairs
- (3) 7. uncle--nephew;;aunt-- 1. brother 2. sister 3. niece 4. cousin
- (2) 8. finger--hand;;toe-- 1. body 2. foot 3. skin 4. nail
- (4) 9. cannon--rifle;;big-- 1. bullet 2. gun 3. army 4. little
- (4) 10. man--home;;bird-- 1. fly 2. insect 3. worm 4. nest
- (3) 11. complex--simple;;hard-- 1. brittle 2. money 3. easy 4. work
- (4) 12. yes--affirmative;;no-- 1. think 2. knowledge 3. yes 4. negative
- (2) 13. above--top;;below-- 1. above 2. bottom 3. sea 4. hang
- (2) 14. prince--princess;;king-- 1. palace 2. queen 3. president 4. kingdom
- (2) 15. sailor--navy;;soldier-- 1. gun 2. private 3. army 4. fight
- (2) 16. left--right;;west-- 1. south 2. direction 3. east 4. north

## TEST 7 (continued)

- ( 1 ) 17. mountain--valley;;genius-- 1. idiot 2. write 3. think  
4. brain
- ( 2 ) 18. music--soothing;;noise-- 1. hear 2. distracting  
3. sound 4. report
- ( 2 ) 19. breeze--cyclone;;shower-- 1. bath 2. cloud-burst  
3. winter 4. spring
- ( 2 ) 20. devil--bad;;angel-- 1. Gabriel 2. good 3. face  
4. heaven
- ( 4 ) 21. good--bad;;long-- 1. tall 2. big 3. snake 4. short
- ( 1 ) 22. spring--summer;;autumn-- 1. winter 2. warm 3. har-  
vest 4. rise
- ( 3 ) 23. abide--stay;;depart-- 1. come 2. hence 3. leave  
4. late
- ( 4 ) 24. sled--runner;;buggy-- 1. horse 2. carriage 3. har-  
ness 4. wheel
- ( 4 ) 25. succeed--fail;;praise-- 1. lose 2. friend 3. God  
4. blame
- ( 3 ) 26. clock--time;;thermometer-- 1. cold 2. weather  
3. temperature 4. mercury
- ( 3 ) 27. love--friend;;hate-- 1. malice 2. saint 3. enemy  
4. dislike
- ( 3 ) 28. people--house;;bees-- 1. thrive 2. sting 3. hive  
4 thick
- ( 4 ) 29. Indiana--United States;;part-- 1. hair 2. China  
3. Ohio 4. whole
- ( 3 ) 30. corn--horse;;bread-- 1. daily 2. flour 3. man  
4. butter
- ( 4 ) 31. agree--quarrel;;friend-- 1. comrade 2. need 3. moth-  
er 4. enemy
- ( 3 ) 32. city--mayor;;army-- 1. navy 2. soldier 3. general  
4. private
- ( 3 ) 33. ocean--pond;;deep-- 1. sea 2. well 3. shallow  
4. steep
- ( 2 ) 34. darkness--stillness;;light-- 1. moonlight 2. sound  
3. sun 4. window

## TEST 7 (continued)

- (3) 35. esteem--friends;;despise-- 1. forsake 2. detest  
3. enemies 4. people
- (2) 36. fear--anticipation;;regret-- 1. vain 2. memory  
3. express 4. resist
- (4) 37. square--cube;;circle-- 1. line 2. round 3. square  
4. sphere
- (2) 38. rudder--ship;;tail-- 1. sail 2. bird 3. dog 4. cat
- (1) 39. character--important;;complexion-- 1. trivial  
2. blonde 3. brunette 4. good
- (3) 40. moon--earth;;earth-- 1. ground 2. Mars 3. sun 4. sky
- 

## TEST 8

- (1) 1. The volt is used in measuring 1. electricity 2. wind  
power 3. rainfall 4. water power
- (1) 2. Alfalfa is a kind of 1. hay 2. corn 3. fruit 4. rice
- (3) 3. The Leghorn is a kind of 1. cow 2. horse 3. fowl  
4. granite
- (1) 4. Ivory is obtained from 1. elephants 2. mines 3. oys-  
ters 4. reefs
- (4) 5. Dewey defeated the Spanish fleet in 1. Newport News  
2. Boston Harbor 3. China 4. Manila Bay
- (1) 6. The piccolo is used in 1. music 2. stenography  
3. bookbinding 4. lithography
- (2) 7. Jane Addams is known as a 1. singer 2. social worker  
3. actress 4. scientist
- (1) 8. The most prominent industry of Chicago is 1. packing  
2. brewing 3. automobiles 4. flour
- (2) 9. Scrooge appears in 1. Vanity Fair 2. The Christmas  
Carol 3. Romola 4. Henry IV
- (3) 10. Cambric is a 1. dance 2. fabric 3. food 4. color
- (4) 11. Pasteur is most famous in 1. politics 2. literature  
3. war 4. science
- (2) 12. The silo is used in 1. fishing 2. farming 3. hunting  
4. athletics

## TEST 8 (continued)

- (2) 13. Arson is a term used in 1. medicine 2. law 3. theology 4. pedagogy
- (2) 14. The larynx is in the 1. head 2. neck 3. abdomen 4. shoulder
- (3) 15. Bombay is a city in 1. China 2. Egypt 3. India 4. Japan
- (2) 16. The author of "Treasure Island" is 1. Poe 2. Stevenson 3. Kipling 4. Hawthorne
- (3) 17. A puck is used in 1. tennis 2. football 3. hockey 4. golf
- (2) 18. Artichoke is a kind of 1. hay 2. corn 3. vegetable 4. fodder
- (3) 19. The multigraph is a kind of 1. typewriter 2. pencil 3. copying-machine 4. phonograph
- (2) 20. The Merino is a kind of 1. horse 2. sheep 3. goat 4. cow
- (4) 21. John Wesley was most famous in 1. literature 2. science 3. war 4. religion
- (4) 22. Salsify is a kind of 1. snake 2. fish 3. lizard 4. vegetable
- (2) 23. Mauve is the name of a 1. drink 2. color 3. fabric 4. food
- (3) 24. Darwin was most famous in 1. literature 2. science 3. war 4. politics
- (3) 25. Little Nell appears in 1. Vanity Fair 2. Romola 3. The Old Curiosity Shop 4. Henry IV
- (3) 26. Alfred Noyes is famous as a 1. painter 2. poet 3. musician 4. sculptor
- (2) 27. Eucalyptus is a 1. machine 2. tree 3. drink 4. fabric
- (4) 28. Cribbage is played with 1. rackets 2. mallets 3. dice 4. cards
- (4) 29. Turpentine comes from 1. petroleum 2. ore 3. hides 4. trees
- (4) 30. Rio Janeiro is a city of 1. Spain 2. Argentina 3. Portugal 4. Brazil
- (7) 31. Sapphires are usually 1. blue 2. red 3. green 4. yellow

## TEST 6 (continued)

- ( / ) 32. The iguana is a 1. reptile 2. bird 3. fish 4. insect
- ( / ) 33. The number of a Papuan's legs is 1. two 2. four  
3. six 4. eight
- ( 3 ) 34. The carbine is a kind of 1. pistol 2. cannon 3. mus-  
ket 4. sword
- ( 2 ) 35. The U. S. Naval Academy is at 1. West Point 2. An-  
napolis 3. New Haven 4. Ithaca
- ( 3 ) 36. A regular five-sided figure is 1. scalene 2. rhom-  
boid 3. equilateral 4. elliptical
- ( 3 ) 37. Kale is a 1. fish 2. lizard 3. vegetable 4. snake
- ( 2 ) 38. The Cooper Hewitt lamp used the vapor of 1. gasoline  
2. mercury 3. tungsten 4. alcohol
- ( / ) 39. Cornell University is at 1. Ithaca 2. Cambridge  
3. Annapolis 4. New Haven
- ( 2 ) 40. Napoleon defeated the Austrians at 1. Friedland  
2. Wagram 3. Waterloo 4. Leipzig

## APPENDIX B

### DIFFICULTY OF ITEMS IN THE REVISED TESTS

The following tables give the difficulty and source of each item used in the revised forms, except for the directions and number series completion tests.\*

TABLE XVII

#### MEAN DIFFICULTY OF ITEMS IN EACH TEST

	Form A	Form B	Form C
Test 2	-0.90	-0.93	-0.93
Test 3	-1.79	-1.79	-1.79
Test 4	-1.05	-1.04	-1.05
Test 5	-1.51	-1.52	-1.45
Test 7	-1.23	-1.23	-1.23
Test 8	-0.80	-0.77	-0.79

Read table thus: The mean difficulty of items in sigma units of test 2, form A, is -0.90; of form B, is -0.93; of form C, is -0.93.

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\* See Appendix C for difficulties of the new items in test 1. The five forms of the number series completion test were found, when analysed, to consist of two series of items combined in different ways. Since the position of an item in the test seemed to affect its difficulty value, a composite criterion of mean difficulty value and mean position in the original test after items were rearranged in order of difficulty, as in Table XV, was used to determine position of items in the new test.

TABLE XVIII

SOURCE AND DIFFICULTY OF EACH  
ITEM SELECTED FOR TEST 2

Item	Form A		Form B		Form C	
	Source	Diffi- culty	Source	Diffi- culty	Source	Diffi- culty
1	7- 1	-2.29	9- 1	-3.00	6- 1	-3.00
2	7- 2	-2.02	9- 2	-1.96	5- 2	-2.00
3	8- 5	-1.89	9- 5	-1.77	5- 5	-1.82
4	5- 4	-1.58	8- 3	-1.53	7- 3	-1.51
5	6- 6	-1.43	9- 6	-1.41	7- 4	-1.42
6	9- 3	-1.35	9- 4	-1.27	6- 7	-1.40
7	7- 7	-1.23	9- 7	-1.26	6-11	-1.40
8	7-11	-1.21	9-12	-1.25	5- 8	-1.19
9	7- 8	-1.17	9-17	-1.22	8- 6	-1.06
10	7-18	-0.97	9-11	-0.93	5-14	-0.94
11	7-17	-0.78	9-18	-0.67	5-18	-0.82
12	6-10	-0.70	9- 9	-0.78	5-12	-0.75
13	6-12	-0.61	9-14	-0.60	6- 9	-0.67
14	7-14	-0.57	9- 8	-0.58	6-20	-0.57
15	8- 9	-0.55	9-10	-0.51	5-16	-0.52
16	6-20	-0.52	9-15	-0.49	6-17	-0.39
17	5-15	-0.10	9-13	-0.03	8-10	-0.12
18	8-16	0.00	9-20	0.00	8-13	-0.05
19	7-13	0.17	9-16	0.04	8-19	0.32
20	6-19	0.74	9-19	0.84	6-15	0.69

Read table thus; Item 1 in form A of the revised test was item 1 of form 7, and has a sigma difficulty value of -2.29; item 1 in form B was item 1 of form 9, and has a sigma difficulty value of -3.00; and so on.



TABLE XIX  
SOURCE AND DIFFICULTY OF EACH  
ITEM SELECTED FOR TEST 3

Item	Form A		Form B		Form C	
	Source	Diffi- culty	Source	Diffi- culty	Source	Diffi- culty
1	8- 4	-3.00	6- 1	-3.00	5- 3	-3.00
2	8-15	-3.00	6- 4	-3.00	5- 6	-3.00
3	9- 1	-3.00	6- 7	-3.00	5- 8	-3.00
4	9- 4	-3.00	7- 5	-3.00	5-12	-3.00
5	8- 1	-2.58	8- 5	-2.58	8- 8	-2.33
6	5-11	-2.20	9-10	-2.21	9- 6	-2.24
7	6-13	-2.03	6- 5	-2.00	5- 2	-2.00
8	5- 4	-1.99	6-10	-1.98	7-13	-1.97
9	8- 7	-1.83	5-13	-1.79	8-12	-1.93
10	6- 9	-1.67	6-15	-1.69	7-10	-1.73
11	5-10	-1.63	9- 3	-1.64	7-15	-1.65
12	7-16	-1.59	7- 9	-1.56	8- 3	-1.57
13	8-13	-1.40	9- 2	-1.43	6- 2	-1.40
14	5-12	-1.34	7-12	-1.32	7- 3	-1.36
15	5- 7	-1.27	9- 8	-1.27	9-11	-1.20
16	9-15	-1.15	6-12	-1.14	9- 7	-1.13
17	9-12	-0.99	8-11	-0.99	7- 8	-1.01
18	6-14	-0.86	5-14	-0.87	5-15	-0.84
19	6-16	-0.74	7-11	-0.72	6-16	-0.74
20	8-10	-0.54	8-14	-0.54	8-10	-0.54

Read table thus: Item 1 in form A of the revised test was item 4 of form 8, and has a sigma difficulty value of -3.00; item 1 in form B was item 1 of form 6, and has a sigma difficulty value of -3.00; and so on.

TABLE XX

SOURCE AND DIFFICULTY OF EACH  
ITEM SELECTED FOR TEST 4

Item	Form A		Form B		Form C	
	Source	Diffi- culty	Source	Diffi- culty	Source	Diffi- culty
1	6- 1	-3.00	8- 1	-3.00	9- 2	-3.00
2	6- 7	-3.00	9- 4	-3.00	9- 6	-3.00
3	8- 2	-2.34	8- 5	-2.58	8-16	-2.33
4	7- 2	-2.29	9- 5	-2.24	6- 2	-2.28
5	9- 8	-2.24	8-12	-2.18	9-20	-2.23
6	5- 6	-2.00	6- 4	-2.00	7- 7	-2.02
7	5- 9	-1.99	7- 6	-1.84	9-14	-1.96
8	6-14	-1.82	6- 3	-1.82	8- 6	-1.82
9	7- 5	-1.71	6-26	-1.77	8- 4	-1.71
10	8-13	-1.66	6-12	-1.69	9-13	-1.64
11	8-31	-1.47	9-10	-1.43	6- 6	-1.49
12	7- 3	-1.36	7- 8	-1.36	7-12	-1.36
13	5-14	-1.34	6-10	-1.34	9-36	-1.35
14	5-15	-1.32	8- 9	-1.31	8- 3	-1.33
15	8-11	-1.30	7-25	-1.28	9- 7	-1.27
16	6- 9	-1.20	6-13	-1.20	9- 9	-1.21
17	5-29	-1.18	6-24	-1.16	5-22	-1.16
18	5-20	-1.14	9-18	-1.14	9-26	-1.14
19	6-25	-1.08	7-14	-1.08	9-11	-1.08
20	5-12	-1.05	6-17	-1.05	7-22	-1.05
21	7-11	-0.97	7-27	-0.97	9-34	-0.97
22	6-21	-0.88	7-33	-0.88	5-21	-0.89
23	6-11	-0.85	5-24	-0.85	9-21	-0.86
24	9-16	-0.83	6-23	-0.84	9-22	-0.82
25	6-19	-0.79	7-23	-0.79	6-19	-0.78
26	8- 8	-0.67	7-35	-0.69	7-10	-0.70
27	6-31	-0.60	8-29	-0.59	7-40	-0.60
28	7-29	-0.53	9-37	-0.51	9-27	-0.52
29	6-17	-0.46	6-20	-0.48	8-23	-0.47
30	9-39	-0.39	9-32	-0.39	9-40	-0.39
31	5-17	-0.31	7-21	-0.34	7-20	-0.32
32	6-35	-0.27	7-28	-0.27	9-36	-0.29
33	5-33	-0.25	7-19	-0.23	8-28	-0.23
34	6-29	-0.21	7-18	-0.19	6-26	-0.20
35	6-18	-0.13	6-36	-0.14	8-39	-0.14
36	6-37	-0.05	8-34	-0.06	8-35	-0.09
37	6-28	0.00	7-26	0.00	9-33	0.00
38	6-38	0.07	7-39	0.07	9-24	0.09
39	6-30	0.18	8-40	0.18	7-30	0.14
40	6-34	0.61	6-33	0.76	5-25	0.38

TABLE XXI

SOURCE AND DIFFICULTY OF EACH  
ITEM SELECTED FOR TEST 5

Item	Form A		Form B		Form C	
	Source	Diffi- culty	Source	Diffi- culty	Source	Diffi- culty
1	5- 1	-3.00	6- 1	-3.00	9- 1	-2.24
2	5- 4	-3.00	6- 4	-3.00	9- 2	-2.24
3	6- 5	-2.28	7- 8	-2.29	9- 3	-2.24
4	6- 7	-2.28	7-10	-2.29	9- 4	-2.24
5	8-13	-2.05	9- 5	-2.24	9-13	-2.23
6	5-12	-2.00	7- 4	-2.02	8- 7	-2.05
7	9-16	-1.89	6-15	-1.98	8- 4	-1.82
8	5-14	-1.82	6- 3	-1.82	5-17	-1.79
9	7-19	-1.75	8-14	-1.78	9- 9	-1.77
10	7- 5	-1.71	7- 6	-1.71	8-15	-1.71
11	7- 7	-1.60	7- 9	-1.60	9-22	-1.66
12	8-18	-1.54	7-12	-1.51	8-21	-1.54
13	8-10	-1.48	6- 2	-1.49	5-22	-1.46
14	7- 2	-1.36	7-11	-1.43	5-15	-1.41
15	5-11	-1.33	8-20	-1.32	8- 6	-1.35
16	6-21	-1.20	8-19	-1.20	8-16	-1.20
17	6-10	-1.07	5-24	-1.07	6-17	-1.10
18	9-17	-1.04	7-16	-1.00	8-11	-1.05
19	6-24	-0.97	7-22	-0.99	9-24	-1.01
20	5-19	-0.75	7-17	-0.76	9-19	-0.82
21	5-21	-0.70	7-23	-0.74	9-11	-0.69
22	6-23	-0.67	6-22	-0.60	6-16	-0.62
23	6-20	-0.59	7-21	-0.50	9-21	-0.47
24	8-22	-0.23	7-24	-0.13	9-15	-0.12

Read table thus: Item 1 in form A of the revised test was item 1 of form 5, and has a sigma difficulty value of -3.00; item 1 in form B was item 1 of form 6, and has a sigma difficulty value of -3.00; and so on.

TABLE XXII

SOURCE AND DIFFICULTY OF EACH  
ITEM SELECTED FOR TEST 7

Item	Form A		Form B		Form C	
	Source	Diffi- culty	Source	Diffi- culty	Source	Diffi- culty
1	6- 1	-3.00	7- 1	-3.00	8- 2	-3.00
2	7- 3	-3.00	7- 2	-3.00	8- 8	-3.00
3	6- 3	-2.28	7- 7	-2.29	7-22	-2.28
4	7-23	-2.24	9- 1	-2.24	9- 2	-2.24
5	7- 4	-2.02	7-12	-2.02	7-14	-2.02
6	6- 8	-2.00	6-23	-2.00	8-30	-2.00
7	8- 6	-1.89	9-22	-1.91	9-18	-1.92
8	6- 7	-1.82	6- 9	-1.82	8- 5	-1.82
9	7-27	-1.79	9- 3	-1.77	9-12	-1.77
10	5-10	-1.69	6-21	-1.68	5- 9	-1.69
11	9- 9	-1.64	6-34	-1.65	9-31	-1.62
12	5-11	-1.58	6-11	-1.58	8-24	-1.58
13	9- 4	-1.53	9-11	-1.53	9- 5	-1.53
14	5-26	-1.48	6-20	-1.48	7-25	-1.48
15	7-32	-1.42	7- 6	-1.43	7- 8	-1.43
16	6-22	-1.40	5-35	-1.41	6-13	-1.41
17	5-33	-1.38	6-38	-1.38	9-36	-1.36
18	9- 7	-1.35	5-21	-1.33	8-38	-1.32
19	6-32	-1.31	6-37	-1.31	9-20	-1.31
20	8-35	-1.28	8-33	-1.27	9-10	-1.27
21	8- 7	-1.25	6-17	-1.26	8-10	-1.26
22	6-36	-1.21	7-24	-1.21	8- 3	-1.21
23	8-26	-1.17	8-27	-1.18	8-34	-1.18
24	6-14	-1.16	6-16	-1.16	7-20	-1.16
25	9-16	-1.13	8-36	-1.12	9-26	-1.13
26	6-27	-1.11	7-21	-1.11	9-37	-1.10
27	6-12	-1.09	8-39	-1.09	8-15	-1.09
28	8-23	-1.06	6-35	-1.06	9-27	-1.08
29	8- 4	-1.01	8-16	-1.00	8-32	-1.00
30	7-19	-0.97	8-19	-0.98	9- 8	-0.98
31	8-12	-0.96	6- 5	-0.95	8-18	-0.94
32	6-40	-0.84	7-13	-0.82	5-25	-0.85
33	6-33	-0.75	7-31	-0.76	6-26	-0.78
34	5-31	-0.67	7-30	-0.67	9-30	-0.68
35	7-38	-0.49	8-31	-0.51	6-31	-0.58
36	8-25	-0.46	8-20	-0.44	9-38	-0.49
37	5-36	-0.23	7-36	-0.29	9-35	-0.32
38	6-28	-0.03	5-37	-0.08	5-34	-0.13
39	8-28	0.00	7-33	0.02	7-37	0.00
40	7-39	0.25	6-25	0.33	5-38	0.57

TABLE XXIII

## SOURCE AND DIFFICULTY OF EACH

## ITEM SELECTED FOR TEST 8

Item	Form A		Form B		Form C	
	Source	Diffi- culty	Source	Diffi- culty	Source	Diffi- culty
1	7-11	-3.00	6-29	-3.00	9-37	-3.00
2	5- 3	-2.28	8- 6	-2.34	7-11	-3.00
3	8- 3	-2.28	8-35	-2.28	6- 6	-2.28
4	6-14	-2.28	9- 3	-2.24	8-15	-1.97
5	8-33	-1.92	8-37	-1.89	9-36	-1.82
6	8-22	-1.76	8-26	-1.81	9-24	-1.76
7	8-24	-1.64	E-17*	-1.69	E-17*	-1.69
8	8-25	-1.49	7-15	-1.60	9- 4	-1.53
9	8-28	-1.42	5-40	-1.47	5-40	-1.47
10	E- 2*	-1.41	8-23	-1.37	9-25	-1.41
11	5- 4	-1.34	8-30	-1.37	8-30	-1.37
12	5- 2	-1.25	7-40	-1.28	9-34	-1.34
13	7-17	-0.98	5- 5	-1.15	9-33	-1.16
14	7-30	-0.98	7-31	-0.98	7-18	-1.07
15	8-20	-0.95	8- 4	-0.94	5-20	-1.03
16	7-14	-0.93	6-12	-0.92	9-26	-1.01
17	8-21	-0.84	8-36	-0.86	9-35	-0.84
18	8-11	-0.76	6-21	-0.79	8-11	-0.76
19	9-18	-0.69	5-21	-0.75	9-22	-0.74
20	6-27	-0.68	6-24	-0.70	7- 3	-0.70
21	5-15	-0.64	6-18	-0.67	6-27	-0.68
22	6-36	-0.62	9-11	-0.66	5-11	-0.61
23	6-30	-0.53	5-11	-0.61	5-37	-0.54
24	7-12	-0.50	5-19	-0.59	6-30	-0.53
25	7-39	-0.46	6-14	-0.54	9-31	-0.49
26	8-12	-0.37	5-16	-0.41	8-16	-0.44
27	8-40	-0.31	7-33	-0.33	9-20	-0.41
28	8-31	-0.29	7-13	-0.30	9- 2	-0.40
29	9-13	-0.24	8-32	-0.24	5-27	-0.35
30	9-14	-0.24	8-17	-0.24	9-14	-0.24
31	6-32	-0.18	E- 3*	-0.16	8- 5	-0.22
32	7-37	-0.16	9-30	-0.09	9-17	-0.06
33	6-35	-0.12	6-16	-0.02	9-32	-0.02
34	7-23	-0.03	8-14	-0.01	9-21	0.02
35	6-13	0.03	8-27	0.01	9-13	0.03
36	6-26	0.04	7- 5	0.25	9-40	0.07
37	5-13	0.09	6- 2	0.32	9-12	0.21
38	6-34	0.36	6-25	0.40	9-39	0.46
39	6-31	0.78	7-29	0.76	8-13	0.96
40	8-39	1.54	8-34	1.51	8-39	1.54

\* Items marked E may be found on page 88.

APPENDIX C

TRIALS OF NEW ITEMS

The actual tests given for trial of new information items, new types of items for the directions test, and test 1, form 9, of the Army Alpha intelligence test with written directions are shown on the following pages.

TABLE XXIV

DIFFICULTIES OF NEW ITEMS

Item	Information	Directions	Written Directions
1	-1.34	-1.95	-2.07
2	-1.41	-1.95	-1.43
3	-0.16	-2.23	-1.02
4	0.01	-3.00	-0.80
5	-0.21	-2.23	-0.66
6	-1.41	-1.95	-1.76
7	-0.33	-1.63	-1.19
8	0.61	-1.95	-1.18
9	-0.72	-0.06	-0.98
10	-0.33	-0.65	-0.59
11	-0.68	-1.43	-0.12
12	0.27	-0.87	-0.74
13	-0.88	0.26	
14	-1.50	-0.84	
15	-0.60	-2.23	
16	0.38	-0.26	
17	-1.69	-1.02	
18		-1.63	
19		-1.20	
20		-0.50	

Read table thus; The sigma difficulty value of item 1 in the experimental information test is -1.34; of item 1 in the experimental directions test is -1.95; and of item 1 in test 1, form 9, with written directions is -2.07.

## TEACHERS COLLEGE EMPORIA

WRITE YOUR NAME ON THE PERFO-SCORE SHEET. DO NOT WRITE IT ON THIS SHEET.

DIRECTIONS: Read each of the following statements and choose the one of the four responses which makes the truest sentence. Then, on the Perfo-score answer sheet circle the correct letter according to the directions on that sheet. Make the circles distinct and large enough to be readily seen.

EXAMPLE: France is in a. Europe b. Asia c. Africa d. Australia.  
The correct answer is Europe, so "a" would be circled on the answer sheet.

BE SURE TO READ THE DIRECTIONS ON THE PERFO-SCORE ANSWER SHEET.

The earth was circumnavigated by a. Marco Polo b. Columbus c. Magellan  
d. Hudson.

Marie Curie was a a. singer b. writer c. actress d. scientist.

Diesel engines are driven by a. alcohol b. electricity c. fuel oil d. gasoline

Jenny Lind was a a. singer b. writer c. nurse d. actress.

Connecting rods are used in the a. brakes b. generator c. motor  
d. steering gear.

Kathleen Norris is a a. writer b. pianist c. golfer d. actress.

Needle valves control the flow of a. gasoline b. cylinder oil c. air  
d. water

Sarah Bernhardt was a a. writer b. singer c. painter d. actress.

Sodium chloride is a. water b. table salt c. soda d. lime.

Fujiyama is a a. candy b. mountain c. city d. lake.

Florence Nightingale was a a. writer b. singer c. actress d. nurse.

Phidias was a a. statesman b. sculptor c. orator d. athlete.

Schumann-Heink is known as a a. scientist b. writer c. singer d. actress.

Huron is a a. fish b. lake c. musician d. mountain.

H. G. Wells is a a. writer b. cartoonist c. statesman d. boxer.

Calcium carbonate is a. table salt b. soda c. bakelite d. limestone.

Jane Addams is known as a a. singer b. social worker c. actress d. scientist.

Name \_\_\_\_\_

Classification \_\_\_\_\_

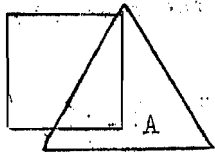
INSTRUCTIONS: Look at the figure and read the statements about it. Select the statement which describes a feature of the figure correctly, and write the number of that statement in the parenthesis at the right.



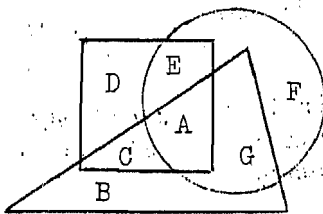
1. There are crosses in the: 1. second ( )  
and fourth circles. 2. first and third  
circles. 3. second and fifth circles.



2. The circles connected are the: 1. sec- ( )  
ond and fifth. 2. first and third.  
3. second and fourth.



3. The letter A is: 1. in the square only. ( )  
2. in the square and triangle. 3. in  
the triangle only.



4. The letter B is: 1. in the circle only. ( )  
2. in the square and triangle. 3. in  
the triangle only.



5. The letter E is: 1. in the circle only. ( )  
2. in the square and circle. 3. in the  
square, circle, and triangle.

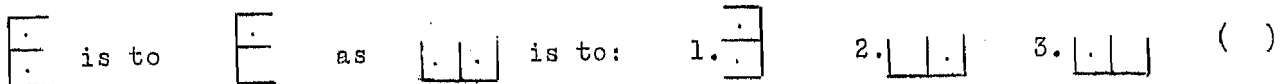
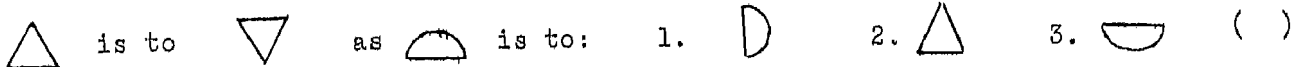
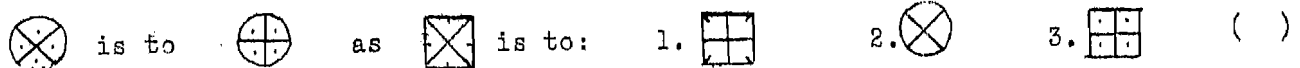
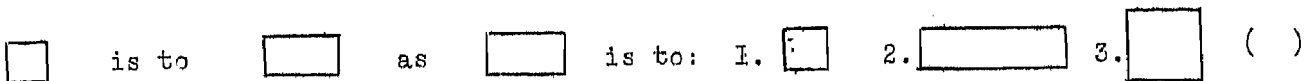
6. The number in the second circle is ( )  
between: 1. four and six. 2. five and  
twelve. 3. ten and twenty.

A B C D E F G H I J

7. The fourth letter from the right is the: ( )  
1. middle letter in begin. 2. middle  
letter in bulge. 3. first letter in  
morning.

3/4-56-31-52-25-47

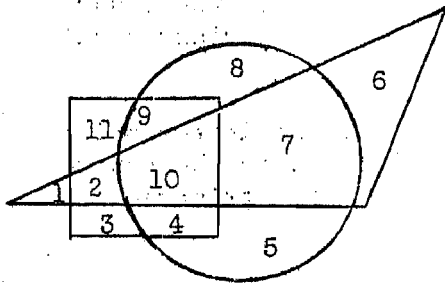
8. The numbers crossed out are: 1. more ( )  
than twenty and less than thirty.  
2. more than thirty and less than forty.  
3. more than fifty and less than sixty.





Write in the parentheses what is asked:

- 13. Print the fifth letter to the right of the letter which is midway between K and O in the alphabet. ( )
- 14. Print the last letter of the word (adjective) which is the opposite of light. ( )
- 15. Print the middle letter in the longer of these two words: miracle, letter. ( )
- 16. In a foreign language, lani dola means big trees, and reti dola means big women. Print the first letter of the word for women. ( )
- 17. If 5 is more than 3, write the number 4, unless 4 is more than 6, in which case write the number 5. ( )



- 18. What number is in the space which is in the triangle and circle but not in the square? ( )
- 19. What number is in the same pair of figures as the number 4? ( )
- 20. How many spaces are there that are in two and only two figures? ( )

ARMY GROUP EXAMINATION ALPHA

Name ..... Age ..... Date .....

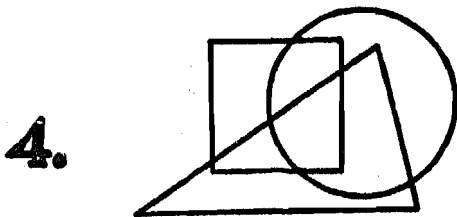
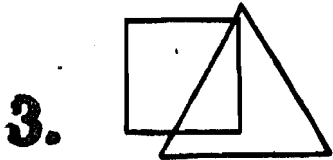
School ..... City ..... State .....

In what Country or State born? ..... Years in U. S. .... Race .....

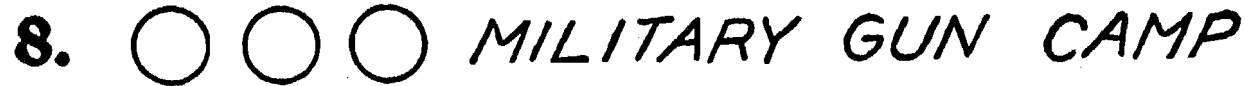
Occupation ..... Monthly wages ..... Sex .....

Schooling: Grades 1. 2. 3. 4. 5. 6. 7. 8: High or Prep. School, Year 1. 2. 3. 4: College, Year 1. 2. 3. 4.

TEST 1



7. A B C D E F G H I J K L M N O P



9. 34-79-56-87-68-25-82-47-27-31-64-93-71-41-52-99



12. 1 2 3 4 5 6 7 8 9

Score.

1	
2	
3	
4	
5	
6	
7	
8	
T	

## TEACHERS COLLEGE EMPORIA

## ARMY ALPHA--Test I

## (Special Directions)

## FORM IX

The directions on this page refer to the figures on the other page which has been handed to you. Read the directions here and make the marks as directed on the other page.

1. Look at the circles at 1. Make a cross in the first circle and also a figure 1 in the last circle.
2. Look at 2, where the circles have numbers in them. Draw a line from Circle 2 to Circle 5 that will pass below Circle 3 and above Circle 4.
3. Look at the square and triangle at 3. Make a figure 2 in the space which is in the triangle, but not in the square, and also make a figure 3 in the space which is in the square and in the triangle.
4. Look at 4. Make a figure 2 in the space which is in the triangle, but not in the circle or square, and also make a figure 3 in the space which is in the square and circle, but not in the triangle.
5. Look at 5. If a captain is superior to a corporal, put a cross in the second circle; if not, draw a line under the word NO.
6. Look at 6. Put in the third circle the right answer to the question: How many months has a year? In the fourth circle do nothing, but in the fifth circle put any number that is a wrong answer to the question that you just answered correctly.
7. Look at 7. Cross out the letter just after G and also draw a line under the second letter after H.
8. Look at 8. Notice the three circles and the three words. Make in the first circle the third letter of the first word; in the second circle the first letter of the second word, and in the third circle the first letter of the third word.
9. Look at 9. Cross out each number that is more than 60 but less than 70.
10. Look at 10. Notice that the drawing is divided into five parts. Put a 2 or a 3 in each of the two largest parts and any number between 6 and 9 in the part next in size to the smallest part.
11. Look at 11. Draw a line through every even number that is not in a square, and also through every odd number that is in a square with a letter.
12. Look at 12. If 3 is more than 1, cross out the number 2 unless 2 is more than 4, in which case draw a line under the number 3.

(over)

KUHLMANN-ANDERSON--TEST 35

Name \_\_\_\_\_

Directions: You are to read this page and do exactly as you are told to do.

Draw a line under the middle one of these three numbers: 3 8 2. Write here.....a word meaning the opposite of good. Draw a line through the middle letter in the longer of these two words: Revenge. Assert. Write here.....a word of five letters meaning the opposite of slow. Write here.....a word which rhymes with hay and means a part of a week. Draw a line after each of those two letters A B such that the first line is one-half of the second. Think what year this is, then write here.....the digits completely reversed, the one which is now last coming first. Cross out one digit in each of these numbers which does not appear in the other numbers: 43689, 64378. Put in the correct signs in this example: 12 2 6 = 30. Notice these four numbers: 7, 6, 4, 2, if the difference between the first two is equal to the difference between the last two, write the sum of the first and third numbers here....., if not write the difference between the second and fourth numbers here..... Write here.....an odd number greater than 25 which is divisible by both 7 and 3. Notice these four words: Beauty, happiness, willing, cheerful. If the letter U appears in the same word with the letter E as often as the letter I appears in the same word with the letter N, write here .....the word that has neither A nor U in it, if not write here.....the word with both A and U in it.

## APPENDIX D

### RELIABILITY OF THE TEST

The following correlations were obtained between the forms of the Army Alpha intelligence test given to freshmen at the Kansas State Teachers College of Emporia in September, 1934:

Forms Correlated	Coefficient	Number of Cases
5 and 8	.845 ± .021	88
6 and 8	.938 ± .009	88
7 and 8	.874 ± .017	92
8 and 9	.979 ± .003	79

For intercorrelations of parts, see contingency tables in Yerkes' report.<sup>14</sup>

<sup>14</sup> Yerkes, op. cit., p. 634.

COPY

WAR DEPARTMENT

WASHINGTON

April 1, 1935.

H. E. Schrammel, Director,  
The Kansas State Teachers College of Emporia,  
Emporia, Kansas.

Dear Mr. Schrammel;

I have your letter of March 15, 1935, relative to revising the Army Alpha intelligence test.

In response I am pleased to advise you that there is no objection on the part of the War Department to your revising the form to meet your needs. In this connection it must be understood, however, that if you obtain a copyright of a publication containing matter from a War Department publication such copyright will not preclude the subsequent use of such matter by the War Department. Attention is invited to Section 7 of the Copyright of 1909, which provides: "That no copyright shall subsist in the original text of any work which is in the public domain \* \* \* or in any publication of the United States Government, or in any reprint in whole or in part thereof."

Should you revise the form it is requested that the War Department be furnished several copies of the revision.

Sincerely yours,

(Signed) Harry H. Woodring

Acting Secretary of War.

T.H.

75725