THE EFFECTS OF A BASIC WOODWORKING COURSE ON THE

• IMPROVEMENT OF MANUAL DEXTERITY AND STRENGTH IN THE UPPER EXTREMITIES

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN THE GRADUATE SCHOOL OF THE TEXAS WOMAN'S UNIVERSITY

SCHOOL OF OCCUPATIONAL THERAPY

ΒY

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AUGUST, 1980

ACKNOWLEDGEMENTS

The writer is gratefully indebted to Dr. Nancy Griffin, Dr. David Marshall and Mrs. Jean Judy for their time and patience in assisting me to complete this study. I would also like to thank the occupational therapy and psychology students whose assistance and cooperation made the study possible.

Last, and definitely not least, I would like to thank my family for all of their support and encouragement. I would like to thank my husband, Bernard, whose love, confidence, support and encouragement gave me the will power I needed to complete graduate school.

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CHAPTER I

INTRODUCTION

Statement of the Problem

This study was designed to provide information on the effects of woodworking on manual dexterity and strength in the upper extremities.

Hypothesis

Occupational therapy students who have been trained in the basic woodworking course have significantly better manual dexterity and strength in their upper extremities than psychology students who have not had the course.

Background and Significance of the Study

This study was significant because of the lack of information concerning this topic or any other related subject headings such as strength, hand functions, motor performance, manual dexterity and/or upper extremity function. Several resources such as <u>The Index Medicus</u>, <u>The Journal of Industrial Arts</u>, <u>The Journal of Applied</u> <u>Science</u>, <u>The American Journal of Occupational Therapy</u>, The Educational Resource Information Center, <u>The Cumulative</u> Index to Dissertation Abstracts were used to locate related studies. However, none of the resources or subject headings revealed such information.

The woodworking course taken by the occupational therapy students involved the use of basic hand and power tools. These students were encouraged to become aware of the normal body movements, coordination, strengths and concentration required to perform certain woodworking skills. None of the thirty-one subjects were restricted from an occasional recreational or craft activity.

Definition of Terms

Manual dexterity--coordinated, skilled ease of movement involving the hands.

Manual labor -- "Engaged in an activity or occupation requiring or involving physical skill and energy" (Webster, 1971).

Scales--(Refer to Appendix D) (Kellor, 1971).

 Percentile--test scores are interpreted in terms of percent of the normative population represented by a score made by a person surpassing only that score.

- Standard--represents the arithmetic average equated to percentile points.
- Stanine--the standard scale divided into nine categories.

Upper Extremity--Area from shoulder to fingertip.

Basic Assumption

With any kind of exercise, you would expect improvement. Therefore, a course such as woodworking should help to develop manual dexterity and increase strength in the upper extremities.

The chance of someone else completing some of the required physical work such as sanding and sawing was slim because no one was allowed to take incomplete wood projects out of the shop.

Though none of the subjects were restricted from occasional sports, recreation or crafts activity, this infrequent indulgence did not affect the results.

Limitations of the Study

Seventeen occupational therapy (OT) students enrolled in a sophomore level course in basic woodworking and fourteen students enrolled in a sophomore level psychology course were used as subjects. All subjects were

female volunteers and enrolled in the Texas Woman's University (TWU) during the Spring 1980 semester and were between the ages of 18 and 38. The OT students were the experimental group and the only craft course they were enrolled in was woodworking. The psychology students were the control group and were not enrolled in any craft course. None of the 31 subjects were taking a recreation course, nor would they have taken a woodworking course in the last ten years. None of the subjects were working on a job requiring manual labor nor the daily participation in arts or crafts.

CHAPTER II

METHODS AND PROCEDURES

Procedures for Collecting Data

All subjects were given four separate tests during the first quarter of the Spring 1980 semester as a pretest and the same four tests ten weeks later as the posttest. Each subject was tested individually. The administration of the four tests took approximately one hour of the students' time. (See Appendix C for individual record form.)

Prior to the administration of the tests, each subject was again verbally briefed about this study and its purpose. Upon understanding that no harm would come to them by participating in this study, they were asked to sign a consent form. (See Appendix B). The first battery, The Minnesota Rate of Manipulation (MRMT) Test (American Guidance Service, 1969) was designed to measure arm and hand dexterity for personnel selection. It involved picking up, turning over and replacing of sixty one-inch tall by one-inch in diameter dowels unilaterally and bilaterally. Its five subtests measure gross dexterity as opposed to fine. Another test which was designed for personnel

selection, The Purdue Pegboard (PP) (Purdue Research Foundation, 1948) was administered second. This test involved the picking up, placing and/or assemblage of pins, washers and collars. This test was designed to measure manipulative dexterity for industrial jobs such as packaging and assembly. This test also has five subtests. The third test measured, in pounds, the grip strength in the hands. The Jamar Dynamometer (Kellor, 1971) was used to measure this strength. Since this instrument has an adjustable handle, the subjects were tested in Notch No. two. The subject was given two opportunities to exert her most forceful grip and the highest of the two was recorded. Both of the hands were tested. The fourth and final test measured pinch strength. The Osco Pinch Meter (Kellor, 1971) was used for this and both hands were tested. The subjects were given only one opportunity to exert maximum force utilizing each of the three kinds of prehension listed below:

1. Palmer--the pinch meter was held between the pads of the thumb and index finger.

2. Lateral--The pinch meter was held between the pad of the thumb and the radial side of the index finger.

Three point--The pinch meter was held between the tips of the thumb and index and middle fingers.

Procedure for Treating Data

Each subject of both groups was given four pretests and the same four tests as the posttest. There were several methods of simultaneously comparing means in order to decide if woodworking had improved manual dexterity and strength in the upper extremities. A t-test was considered but in order to use the t-distribution, it must be assumed that the standard deviations of both populations are not significantly different. This was an assumption that could not be made. A second method of treating such data is by analysis of variance. The basic assumptions with this method are that treatment and environment affect the results, that experimental errors are random and that standard deviations are not significantly different. A method where experimental errors are normally distributed and residuals have a common variance would be best. Therefore the analysis of covariance was the method that best interpreted the data of this study. This method adjusts the results after the fact in such a way that performance differences between the groups prior to treatment are effectively removed from consideration. This method also controls for the unreliability of difference or gain scores, controls error and increases precision, estimates missing data, assists in the

interpretation of data with regard to the nature of treatment effects and adjusts the dependent variable for differences in sets of values of corresponding independent variables.

After the data was collected, a one way analysis of covariance was used to determine whether differences occurred due to treatment at the five per cent level for all four tests administered. Since there were numerous values to compute, the BMDP IV computer program was used.

CHAPTER III

DISCUSSION

The study was undertaken for the following purpose: to determine if woodworking improved manual dexterity and strength in the upper extremities. Such information might provide insight as to the importance of retaining and/or adding such a media course to existing occupational therapy curriculums in colleges and universities across the country.

The data was obtained by means of individual testing during the first quarter of the Spring 1980 semester for the pretest and during the last week of classes for the posttest. The students were very enthusiastic during the pretest but they admitted to being mentally and physically exhausted prior to the posttesting. Some of the following statements were made by students to support why they were exhausted:

l. "I just had my neuroanatomy lab comprehensive
exam."

"It's just the end of the semester, and I am tired."

3. "I'm finished with my classes and all I care about is catching my plane home in 2 1/2 hours."

4. "I'm tired because I did not sleep well worrying that I would not improve."

5. "I'm seven months pregnant. That's my excuse." Finally, the students just appeared to be fatigued.

CHAPTER IV

RESULTS

Seventeen occupational therapy students were administered the pretest and seventeen returned for the posttest. Seventeen psychology students were administered the pretest, but only fourteen agreed to return for the posttest. The results were based on the remaining combined total of thirty-one students who participated in the entire study.

For all tests administered, normative data is available. (See Appendix E. F. G.) Individual raw scores are also available. (See Appendix A.)

For all of the following tables (1-18), the estimates of means for the pretest and the posttest are tabled because the type of statistics used required these scores to obtain the needed adjusted posttest scores. This method adjusts the results of the pretest in such a way that performance differences between the groups prior to treatment are effectively removed from consideration. Even though looking at the scores, there seemed to be a trend for the occupational therapy students to score consistently

better than the psychology students, there is no evidence to support that trend. Analysis of covariance produces adjusted scores which do not reflect absolute pretest and posttest scores.

Tables 1-5 show the results of the one way analysis of covariance for the five subtests of the Minnesota Rate of Manipulation Test. The pretest and the posttest were administered ten weeks apart. These scores are based on the time in seconds it took the subject to pick up, turn over and place sixty one-inch tall by one-inch in diameter dowels unilaterally or bilaterally.

TABLE 1

| | OT | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 179.0588 | 176.4286 | | |
| Post | 168.7647 | 166.4286 | | |
| Adjusted Post | 167.95358 | 167.41351 | 0.0365 | NSD |

ESTIMATE OF MEANS FOR THE PLACING TEST OF THE MINNESOTA RATE OF MANIPULATION TEST

The object of the Placing Test was to see how fast the subject could pick up and put the blocks back with one hand. According to the normative data, the mean scores for both groups were in the high range.

TABLE 2

ESTIMATE OF MEANS FOR THE TURNING TEST OF THE MINNESOTA RATE OF MANIPULATION TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 144.4118 | 136.2857 | | |
| Post | 129.7059 | 127.2857 | | |
| Adjusted Post | 126.91962 | 130.66904 | 2.7876 | NSD |

The object of the turning test was to see how fast the subject could turn the blocks over by picking up one block at a time with one hand and putting it down with the other hand. According to the normative data, the mean score for the occupational therapy group was in the very high range and the mean score for the psychology group was in the high range.

TABLE 3

ESTIMATES OF MEANS FOR THE DISPLACING TEST OF THE MINNESOTA RATE OF MANIPULATION TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 134.8824 | 134.5714 | | |
| Post | 124.8235 | 128.0000 | | |
| Adjusted Post | 124.74307 | 128.09770 | 2.2719 | NSD |

The object of the Displacing Test was to see how fast the subject could move the blocks, one at a time, from one hole to another. According to the normative data, the mean score for the occupational therapy group was in the very high range and the mean score for the psychology group was in the high range.

TABLE 4

ESTIMATES OF MEANS FOR THE ONE HAND TURNING AND PLACING TESTS OF THE MINNESOTA RATE OF MANIPULATION TESTS

| | ОТ | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 233.5249 | 217.6429 | | |
| Post | 216.4118 | 208.7143 | | |
| Adjusted Post | 217.08525 | 207.89648 | 2.0556 | NSD |

The object of the One-Hand Turning and Placing Test was to see how fast the subject could put the blocks back into the holes, bottom side up with one hand. According to the normative data, the mean scores for both groups were in the high range.

TABLE 5

ESTIMATES OF MEANS FOR THE TWO-HAND TURNING-PLACING TEST OF THE MINNESOTA RATE OF MANIPULATION TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 135.1176 | 127.0000 | | |
| Post | 124.0588 | 121.5000 | | |
| Adjusted Post | 121.41424 | 124.71128 | 1.4402 | NSD |

The object of the Two-Hand Turning and Placing Test was to see how fast the subject could put the blocks back in the holes, bottom side up, two at a time, using both hands. According to the normative data, the mean score for the occupational therapy group was in the high range and the mean score for the psychology group was in the average range.

Tables 6-10 show the results of the one way analysis of covariance for the five subtests of the Purdue Pegboard Test. Ten weeks lapsed between the pretest and the posttest. The scores are based on number of pins and/or collars and washers the subject could insert and/or assemble in a 30 to 60 second time period unilaterally or bilaterally.

TABLE 6

ESTIMATE OF MEANS FOR THE RIGHT HAND FOR THE PURDUE PEGBOARD TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|----------|----------|---------|-------------|
| Pre | 52.1765 | 51.1429 | | |
| Post | 54.0588 | 54.4286 | | |
| Adjusted Post | 53.69452 | 54.87094 | 1.4560 | NSD |

The object of this test was to see how many pins the subject could insert with the right hand in 30 seconds. According to the normative data, the mean scores for both groups were in the 50th percentile rank.

TABLE 7

ESTIMATE OF MEANS FOR THE LEFT HAND FOR THE PURDUE PEGBOARD TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|----------|----------|---------|-------------|
| Pre | 48.5294 | 49.7857 | | |
| Post | 49.7647 | 50.7857 | | |
| Adjusted Post | 50.17982 | 50.28165 | 0.0070 | NSD |

The object of this test was to see how many pins the subject could insert with the left hand in 30 seconds. According to the normative data, the mean scores for both groups were in the 50th percentile rank.

TABLE 8

ESTIMATES OF MEANS FOR BOTH HANDS FOR THE PURDUE PEGBOARD TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|----------|----------|---------|-------------|
| Pre | 40.5882 | 40.6429 | | |
| Post | 42.1176 | 42.1429 | | |
| Adjusted Post | 42.13332 | 42.12382 | 0.0001 | NSD |

The object of this test was to see how many pins the subject could insert with both hands simultaneously in 30 seconds. The score is based on the number of pairs inserted. According to the normative data, the mean scores for both groups was in the 51st percentile rank.

TABLE 9

ESTIMATE OF MEANS FOR THE SUM OF RIGHT HAND + LEFT HAND + BOTH HANDS FOR THE PURDUE PEGBOARD TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 141.2941 | 141.5714 | | |
| Post | 145.9412 | 145.2143 | 1 | |
| Adjusted Post | 146.03906 | 145.09543 | 0.1032 | NSD |

This score is obtained by summing the scores of the three preceeding tests, Right Hand, Left Hand, and Both Hands. This is not a separately administered test. According to the normative data, the mean score for the occupational therapy group was in the 44th percentile rank and the mean score for the psychology group was in the 41st percentile rank.

TABLE 10

| ESTIMATES | OF | MEANS | FOR | THE | ASSEMBLY | TEST | OF |
|-----------|-----|--------|-------|------|----------|------|----|
| Г | THE | PURDUE | E PEC | BOAR | RD TEST | | |

| | ОТ | Psych | F-Value | Probability |
|---------------|-----------|-----------|---------|-------------|
| Pre | 138.4706 | 136.5714 | | |
| Post | 144.4706 | 138.7857 | | |
| Adjusted Post | 143.83882 | 139.55286 | 1.5354 | NSD |

The object of this test was to see how many Assemblies of pins, washers, collars and washers the subject could make in 60 seconds using both hands to complete one assembly. The score represents the number of parts of full or partial assemblies completed. According to the normative data, the mean score for the occupational therapy group was in the 87th percentile rank and the mean score for the psychology group was in the 81st percentile rank. Tables 11-16 show the results of the one way analysis of covariance for the six subtests of the Osco Pinch Meter Test. Ten weeks lapsed between the pretest and posttest scores. This test is scored in pounds of pressure exerted in palmer, lateral and three-point pinch for right and left hands.

TABLE 11

ESTIMATE OF MEANS FOR RIGHT PALMER PINCH FOR THE OSCO PINCH METER

| | ОТ |)T Psych | | Probability | |
|---------------|----------|----------|--------|-------------|--|
| Pre | 12.8824 | 12.2143 | | | |
| Post | 13.0000 | 12.1429 | | * - w | |
| Adjusted Post | 12.89410 | 12.27145 | 0.8502 | NSD | |

For Right Palmer Pinch, the pinch meter was held between the pads of the right thumb and the right index finger. According to the normative data, the mean scores for both groups were in the 25th percentile rank except those subjects over 29 years of age, and they were in the 50th percentile rank.

TABLE 12

ESTIMATE OF MEANS FOR RIGHT LATERAL PINCH FOR THE OSCO PINCH METER

| | OT | Psych | F-Value | Probability | |
|---------------|----------|----------|---------|-------------|--|
| Pre | 15.8824 | 17.0357 | | | |
| Post | 16.8529 | 17.3929 | | | |
| Adjusted Post | 17.23839 | 16.92481 | 0.2164 | NSD | |

For Right Lateral Pinch, the pinch meter was held between the pads of the right thumb and the radial side of the right index finger. According to the normative data, the mean scores for both groups were in the 90th percentile rank.

TABLE 13

ESTIMATE OF MEAN FOR RIGHT THREE POINT PINCH FOR THE OSCO PINCH METER

| | OT | Psych | F-Value | Probability |
|---------------|----------|----------|---------|-------------|
| Pre | 16.5294 | 17.8214 | | |
| Post | 17.9118 | 18.5000 | | |
| Adjusted Post | 18.19046 | 18.16159 | 0.0010 | NSD |

For Right Three-Point Pinch, the pinch meter was held between the tips of the right thumb and right index and middle fingers. According to the normative data, the mean scores for both groups were above the 90th percentile rank.

TABLE 14

ESTIMATES OF MEANS FOR LEFT PALMER PINCH FOR THE OSCO PINCH METER

| | ОТ | Psych | F-Value | Probability | |
|---------------|----------|----------|---------|-------------|--|
| Pre | 11.8294 | 10.3929 | | | |
| Post | 12.4706 | 11.2500 | | | |
| Adjusted Post | 11.99236 | 11.83071 | 0.0450 | NSD | |

For Left Palmer Pinch, the pinch meter was held between the pads of the left thumb and left index finger. According to the normative data, the mean scores for both groups was in the 25th percentile rank.

TABLE 15

ESTIMATE OF MEANS FOR LEFT LATERAL PINCH FOR THE OSCO PINCH METER

| | OT | Psych | F-Value | Probability |
|---------------|----------|----------|---------|-------------|
| Pre | 15.5000 | 15.0000 | | |
| Post | 16.3529 | 16.0357 | | |
| Adjusted Post | 16.18350 | 16.24146 | 0.0109 | NSD |

For Left Lateral Pinch, the pinch meter was held between the pads of the left thumb and the radial side of the left index finger. According to the normative data, the mean scores for both groups were in the 75th percentile except those subjects whose age was over 35 and they were in the 90th percentile rank.

TABLE 16

ESTIMATES OF MEANS FOR LEFT THREE POINT PINCH OF THE OSCO PINCH METER

| | OT | Psych | F-Value | Probability | |
|---------------|----------|----------|---------|-------------|--|
| Pre | 16.3235 | 15.8214 | | | |
| Post | 17.0588 | 17.3214 | | | |
| Adjusted Post | 16.91554 | 17.49541 | 0.3359 | NSD | |

For Left Three Point Pinch, the pinch meter was held between the tips of the left thumb and left index and middle fingers. According to the normative data, the mean scores were in the 90th percentile rank for both groups.

Tables 17 and 18 show the results of the one way analysis of covariance for the two subtests of the Jamar Dynamometer Test. Ten weeks lapsed between the pretest and posttest scores. This test measures in pounds the amount of grip strength in the hands.

TABLE 17

ESTIMATE OF MEANS FOR NON-DOMINANT HAND FOR THE JAMAR DYNAMOMETER TEST

| | ОТ | Psych | F-Value | Probability |
|---------------|----------|----------|---------|-------------|
| Pre | 57.8235 | 56.5000 | | |
| Post | 51.0588 | 50.5000 | | |
| Adjusted Post | 50.71834 | 50.91344 | 0.0042 | NSD |

The object of this test was to see how tightly the subject could squeeze the Dynamometer with the non-dominant hand. The subject was given two chances and the highest score was recorded. According to the normative data, the mean scores for both groups was between the 25th and 50th percentile rank.

TABLE 18

| | OT | Psych | F-Value | Probability | |
|---------------|----------|----------|---------|-------------|--|
| Pre | 60.3529 | 61.4286 | | | |
| Post | 59.6471 | 54.9286 | | | |
| Adjusted Post | 59.90473 | 54.61568 | 4.5481 | 0.0419 | |

ESTIMATES OF MEANS FOR DOMINANT HAND FOR THE JAMAR DYNAMOMETER TEST The object of this test was to see how tightly a subject could squeeze the Dynamometer with the dominant hand. The subject was given two chances and the highest score was recorded. According to the normative data the mean score for the occupational therapy group was in the 50th percentile and the mean score for the psychology group was in the 25th percentile rank except those subjects over age 29 and they were in the 50th percentile rank.

The analysis of covariance yielded a difference which was significant at the .04 level. The occupational therapy students had a higher mean score.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

The data from the results of testing of seventeen occupational therapy students and fourteen psychology students was analyzed. Even though the study did not support the hypothesis that woodworking improves manual dexterity, it did support the concept that it improves strength in the upper extremities on the dominant side. Since all subjects except one (Subject No. 31) was right hand dominant, the study satisfies the assumption that the dominant hand was used the most.

The one way analysis of covariance on all of the subtests of The Minnesota Rate of Manipulation, The Purdue Pegboard, The Osco Pinch Meter and the Jamar Dynamometer Tests for the Left Hand resulted in no significant difference between the occupational therapy and psychology students on the posttest means adjusted for the pretest differences. (See Tables 1-17.) The covariate accounts for any group differences on the pretests. No effects attributable to treatment were detected.

One comparison produced significant differences. Table 18 shows the results of the one way analysis of

covariance on the Jamar Dynamometer Test for the dominant hand. The treatment group had a significantly higher mean than the control group. The covariate pretest was significantly correlated with the posttest but did not account for all posttest group differences. The equality of slopes test was not significant and satisfies the assumption of homogeneous regression among the groups.

Recommendations for further study include:

 A replication of the present study with larger and heterogeneous groups.

 Since dexterity did not improve significantly, the experimental group should be simultaneously enrolled in a course designed to improve dexterity.

3. Comparison of male with male, female with female and female with male within and between groups comparing all variables.

 Retest to see how long the subjects retained the improvements.

5. Try to choose a group that was relatively stress-free and compare with a group that was likely to be stressed at the end of the semester.

 Study the effects of sequencing of course work in relation to strength and dexterity.

APPENDICES

APPENDIX A

RAW SCORES FOR SUBJECTS 1-31

Lines 1-5 represent the scores obtained on the Minnesota Rate of Manipulation Test in seconds.

Lines 6-10 represent the scores obtained on the Purdue Pegboard Test in amount.

Lines 11-13 represent the scores obtained on the right on the Osco Pinch Meter Test in pounds.

Lines 14-16 represent the scores obtained on the left on the Osco Pinch Meter Test in pounds.

Line 17 represents the scores obtained on the right Jamar Dynamometer in pounds.

Line 18 represents the scores obtained on the left on the Jamar Dynamometer in pounds.

The pretest scores are separated from the posttest scores by a semicolon (;).

For lines 1-10, the first set of numbers preceeding the semicolon represent first, second and third trials for the pretest, and the second set of numbers following the semicolon represent first, second and third trials for the posttest.

| | | | Sub | oject l | - | | |
|-----|------|----|------|---------|----|----|----|
| 1. | 58 | 53 | 56 | ; | 51 | 52 | 50 |
| 2. | 47 | 45 | 43 | ; | 38 | 36 | 39 |
| 3. | 41 | 42 | 44 | ; | 40 | 39 | 43 |
| 4. | 66 | 68 | 65 | ; | 62 | 63 | 68 |
| 5. | 44 | 37 | 37 | ; | 35 | 39 | 35 |
| 6. | 19 | 19 | 20 | ; | 20 | 20 | 19 |
| 7. | 14 | 19 | 18 | ; | 18 | 16 | 17 |
| 8. | 15 | 16 | 15 | ; | 16 | 15 | 16 |
| 9. | 48 | 54 | 53 | ; | 54 | 51 | 52 |
| 10. | 52 | 50 | 53 | ; | 42 | 51 | 49 |
| 11. | 20 | ; | 15.5 | | | | |
| 12. | 21 | ; | 23 | | | | |
| 13. | 15 | ; | 21.5 | | | | |
| 14. | 16.5 | ; | 13.5 | | | | |
| 15. | 20.5 | ; | 23 | | | | |
| 16. | 25 | ; | 18 | | | | |
| 17. | 79 | ; | 82 | - | × | | |
| 18. | 65 | ; | 59 | | | | |

| 1. | 67 | 62 | 57 | ; | 58 | 54 | 54 |
|-----|------|---------|------|---|----|----|----|
| 2. | 47 | 43 | 42 | ; | 49 | 39 | 40 |
| 3. | 44 | 45 | 43 | ; | 41 | 38 | 37 |
| 4. | 91 | 77 | 78 | ; | 74 | 68 | 70 |
| 5. | 46 | 47 | 46 | ; | 48 | 43 | 42 |
| | | 20. 201 | | | | | |
| 6. | 16 | 15 | 17 | ; | 17 | 16 | 17 |
| 7. | 15 | 12 | 15 | ; | 13 | 15 | 13 |
| 8. | 10 | 11 | 11 | ; | 13 | 13 | 14 |
| 9. | 41 | 38 | 43 | ; | 43 | 44 | 44 |
| 10. | 38 | 42 | 42 | ; | 44 | 46 | 44 |
| | | | | | | | |
| 11. | 10.5 | ; | 15 | | | | |
| 12. | 14.5 | ; | 16.5 | | | | |
| 13. | 12.5 | ; | 20.5 | | | | |
| 14. | 9.5 | ; | 10 | | | | |
| 15. | 15.5 | ; | 16 | | | | |
| 16. | 18.5 | ; | 20 | | | | |
| | | | | | | | |
| 17. | 65 | ; | 65 | | | | |
| 18. | 62 | ; | 57 | | | | |

31

Subject 2

| | | | Sub | ject 3 | 3 | | |
|-----|------|----|------|--------|----|----|----|
| 1. | 70 | 64 | 57 | ; | 68 | 65 | 62 |
| 2. | 58 | 56 | 51 | ; | 48 | 48 | 48 |
| 3. | 54 | 50 | 44 | ; | 48 | 45 | 45 |
| 4. | 86 | 80 | 86 | ; | 81 | 81 | 80 |
| 5. | 46 | 49 | 46 | ; | 42 | 45 | 43 |
| 6. | 15 | 18 | 18 | ; | 13 | 16 | 17 |
| 7. | 15 | 15 | 15 | ; | 14 | 13 | 16 |
| 8. | 13 | 14 | 12 | ; | 11 | 11 | 12 |
| 9. | 43 | 47 | 45 | ; | 38 | 40 | 45 |
| 10. | 40 | 40 | 40 | ; | 35 | 40 | 45 |
| 11. | 15 | ; | 14 | | | | |
| 12. | 21 | ; | 17 | | | | |
| 13. | 17 | ; | 19 | | | | |
| 14. | 13 | ; | 16.5 | | | | |
| 15. | 21 | ; | 17 | | | | |
| 16. | 17.5 | ; | 18 | | | | |
| 17. | 25 | ; | 59 | | | | |
| 18. | 23 | ; | 59 | | | | |
| | | | | | | | |
| 1. | 66 | 63 | 64 | ; | 55 | 55 | 55 |
|-----|------|----|------|---|-----|----|----|
| 2. | 50 | 48 | 46 | ; | 45 | 44 | 42 |
| 3. | 47 | 46 | 47 | ; | 39 | 39 | 42 |
| 4. | 82 | 24 | 82 | ; | 70 | 77 | 72 |
| 5. | 59 | 53 | 51 | ; | 47 | 45 | 44 |
| c | 16 | 16 | 16 | - | ٦ ٨ | 10 | 10 |
| 6. | Τ0 | Τ0 | 10 | ; | 14 | 18 | 19 |
| 7. | 11 | 13 | 14 | ; | 15 | 14 | 14 |
| 8. | 11 | 12 | 12 | ; | 13 | 15 | 15 |
| 9. | 38 | 41 | 42 | ; | 42 | 47 | 47 |
| 10. | 39 | 40 | 42 | ; | 48 | 48 | 51 |
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| 11. | 10.5 | ; | 13 | | | | |
| 12. | 19.5 | ; | 18.5 | | | | |
| 13. | 19.5 | ; | 20.5 | | | | |
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| 15. | 18.5 | ; | 17.5 | | | | |
| 16. | 15 | ; | 16 | | | | |
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| 17. | 78 | ; | 70 | | | | |
| 18. | 67 | ; | 55 | | | | |

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| 2. | 48 | 46 | 47 | ; | 44 | 44 | 43 |
| 3. | 44 | 45 | 42 | ; | 41 | 45 | 38 |
| 4. | 77 | 73 | 69 | ; | 73 | 65 | 68 |
| 5. | 45 | 40 | 40 | ; | 41 | 41 | 39 |
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| б. | 13 | 16 | 15 | ; | 16 | 18 | 19 |
| 7. | 15 | 15 | 17 | ; | 15 | 17 | 16 |
| 8. | 12 | 12 | 14 | ; | 13 | 14 | 16 |
| 9. | 40 | 43 | 46 | ; | 44 | 49 | 51 |
| 10. | 38 | 43 | 49 | ; | 46 | 49 | 48 |
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| 11. | 10 | ; | 12.5 | | | | |
| 12. | 16.5 | ; | 16 | | | | |
| 13. | 15 | ; | 19 | | | | |
| 14. | 12.5 | ; | 12.5 | | | | |
| 15. | 18 | ; | 17 | | | | |
| 16. | 18.5 | ; | 20 | | | | |
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| 18. | 72 | ; | 66 | | | | |

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| 2. | 45 | 48 | 44 | ; | 41 | 40 | 40 |
| 3. | 41 | 39 | 39 | ; | 38 | 41 | 41 |
| 4. | 83 | 71 | 74 | ; | 68 | 70 | 61 |
| 5. | 42 | 38 | 39 | ; | 38 | 34 | 35 |
| 6. | 19 | 19 | 18 | ; | 20 | 19 | 19 |
| 7. | 14 | 16 | 17 | ; | 18 | 16 | 16 |
| 8. | 14 | 14 | 14 | ; | 14 | 14 | 14 |
| 9. | 47 | 49 | 49 | ; | 52 | 49 | 49 |
| 10. | 53 | 39 | 45 | ; | 51 | 49 | 51 |
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| 11. | 10.5 | ; | 12.5 | | | | |
| 12. | 11.5 | ; | 14.5 | | | | |
| 13. | 14.5 | ; | 16.5 | | | | |
| 14. | 8.5 | ; | 10 | | | | |
| 15. | 11.5 | ; | 14 | | | | |
| 16. | 14 | ; | 14 | | • | | |
| 17. | 53 | ; | 42 | | | | |
| 18. | 53 | ; | 41 | | | | |

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| 2. | 44 | 43 | 41 | ; | 37 | 40 | 35 |
| 3. | 40 | 43 | 42 | ; | 37 | 35 | 37 |
| 4. | 93 | 75 | 75 | ; | 81 | 75 | 77 |
| 5. | 53 | 48 | 44 | ; | 40 | 39 | 36 |
| 6. | 14 | 19 | 19 | ; | 18 | 19 | 19 |
| 7. | 18 | 18 | 18 | ; | 20 | 20 | 20 |
| 8. | 15 | 16 | 15 | ; | 13 | 15 | 16 |
| 9. | 47 | 53 | 52 | ; | 51 | 54 | 55 |
| 10. | 48 | 48 | 47 | ; | 51 | 51 | 51 |
| 11. | 14 | ; | 10.5 | | | | |
| 12. | 18.5 | ; | 18 | | | | |
| 13. | 18 | ; | 19.5 | | | | |
| 14. | 17 | ; | 17 | | | | |
| 15. | 20 | ; | 20 | | | | |
| 16. | 23 | ; | 26 | | | | |
| 17. | 66 | ; . | 60 | | | | |
| 18. | 70 | ; | 56 | | | | |

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| 1. | 61 | 61 | 55 | ; | 58 | 57 | 60 |
| 2. | 62 | 51 | 45 | ; | 49 | 44 | 45 |
| 3. | 40 | 41 | 39 | ; | 43 | 41 | 43 |
| 4. | 87 | 77 | 76 | ; | 84 | 83 | 76 |
| 5. | 47 | 47 | 43 | ; | 47 | 41 | 38 |
| 6. | 18 | 17 | 19 | ; | 18 | 19 | 16 |
| 7. | 16 | 15 | 16 | ; | 15 | 17 | 17 |
| 8. | 14 | 12 | 14 | ; | 15 | 13 | 13 |
| 9. | 48 | 44 | 49 | ; | 48 | 49 | 46 |
| 10. | 41 | 45 | 47 | ; | 44 | 39 | 50 |
| 11. | 10.5 | ; | 12 | | | | |
| 12. | 10.5 | ; | 12 | | | | |
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| 14. | 11.5 | ; | 11.5 | | | | |
| 15. | 12 | ; | 10.5 | | | | |
| 16. | 13 | ; | 12 | | | | |
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| 18. | 58 | ; | 50 | | | | |

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| 2. | 62 | 58 | 62 | ; | 51 | 49 | 49 |
| 3. | 50 | 51 | 49 | ; | 44 | 44 | 42 |
| 4. | 81 | 82 | 77 | ; | 69 | 75 | 68 |
| 5. | 54 | 50 | 52 | ; | 53 | 45 | 43 |
| 6. | 16 | 18 | 19 | ; | 17 | 19 | 18 |
| 7. | 15 | 17 | 16 | ; | 16 | 17 | 17 |
| 8. | 12 | 13 | 13 | ; | 13 | 14 | 14 |
| 9. | 43 | 48 | 48 | ; | 46 | 50 | 49 |
| 10. | 49 | 51 | 58 | ; | 43 | 57 | 49 |
| 11. | 10.5 | ; | 11.5 | | | | |
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| 17. | 57 | ; | 57 | | | | |
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| 2. | 48 | 44 | 43 | ; | 45 | 39 | 39 |
| 3. | 48 | 49 | 49 | ; | 41 | 42 | 41 |
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| 5. | 55 | 52 | 49 | ; | 45 | 44 | 45 |
| 6. | 17 | 19 | 19 | ; | 20 | 19 | 19 |
| 7. | 16 | 17 | 18 | ; | 18 | 19 | 19 |
| 8. | 14 | 14 | 14 | ; | 14 | 14 | 16 |
| 9. | 47 | 50 | 51 | ; | 52 | 52 | 54 |
| 10. | 47 | 47 | 47 | ; | 51 | 48 | 50 |
| 11. | 15 | ; | 13 | | | | |
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| 13. | 15.5 | ; | 17 | | | | |
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| 15. | 16.5 | ; | 17.5 | | | | |
| 16. | 15 | ; | 16 | | | ÷ | |
| 17. | 61 | ; | 55 | | | | |
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| 1. | 57 | 54 | 54 | ; | 55 | 53 | 53 |
| 2. | 42 | 43 | 44 | ; | 38 | 37 | 38 |
| 3. | 44 | 42 | 45 | ; | 41 | 43 | 38 |
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| 5. | 39 | 36 | 38 | ; | 37 | 38 | 35 |
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| 0. | 19 | 10 | 19 | ĩ | TO | 20 | 19 |
| 7. | 16 | 20 | 17 | ; | 20 | 16 | 17 |
| 8. | 14 | 15 | 15 | ; | 15 | 15 | 13 |
| 9. | 49 | 53 | 51 | ; | 53 | 51 | 49 |
| 10. | 55 | 51 | 54 | ; | 52 | 52 | 49 |
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| 11 | 12.5 | ; | 14 | | | | |
| 12. | 15.5 | ; | 18 | | | | |
| 13. | 15 | ; | 16 | | | | |
| 14. | 11.5 | ; | 12.5 | | ¢. | | |
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| 1. | 57 | 59 | 57 | ; | 57 | 56 | 58 |
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| 2. | 52 | 48 | 47 | ; | 48 | 45 | 42 |
| 3. | 44 | 43 | 42 | ; | 43 | 42 | 43 |
| 4. | 71 | 76 | 73 | ; | 71 | 72 | 71 |
| 5. | 45 | 42 | 41 | ; | 44 | 44 | 38 |
| 6. | 15 | 18 | 18 | ; | 18 | 17 | 17 |
| 7. | 19 | 18 | 17 | ; | 17 | 18 | 17 |
| 8. | 14 | 14 | 15 | ; | 15 | 15 | 15 |
| 9. | 48 | 50 | 50 | ; | 50 | 50 | 49 |
| 10. | 45 | 51 | 44 | ; | 44 | 42 | 49 |
| 11. | 16.5 | ; | 13.5 | | | , | |
| 12. | 14 | ; | 16 | | | | |
| 13. | 16.5 | ; | 19 | | | | |
| 14. | 14.5 | ; | 14.5 | | i. | | |
| 15. | 15 | ; | 17 | | | | |
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| 18. | 69 | ; | 56 | | | | |

| 1. | 61 | 58 | 58 | ; | 58 | 60 | 60 |
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| 2. | 53 | 51 | 48 | ; | 47 | 47 | 44 |
| 3. | 53 | 45 | 48 | ; | 44 | 45 | 43 |
| 4. | 78 | 77 | 79 | ; | 75 | 72 | 74 |
| 5. | 44 | 44 | 45 | ; | 41 | 39 | 39 |
| 6. | 16 | 17 | 17 | ; | 17 | 18 | 17 |
| 7. | 15 | 17 | 16 | ; | 17 | 15 | 17 |
| 8. | 14 | 15 | 13 | ; | 14 | 13 | 13 |
| 9. | 45 | 49 | 46 | ; | 48 | 46 | 47 |
| 10. | 49 | 50 | 45 | ; | 54 | 47 | 53 |
| 11. | 13 | ; | 11.5 | | | | |
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| 13. | 15.5 | ; | 16 | | | | |
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| 15. | 12.5 | ; | 13 | | | | |
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| 1. | 63 | 60 | 59 | ; | 61 | 58 | 56 |
| 2. | 47 | 46 | 46 | ; | 42 | 41 | 42 |
| 3. | 51 | 51 | 46 | ; | 44 | 45 | 44 |
| 4. | 77 | 81 | 73 | ; | 69 | 70 | 68 |
| 5. | 42 | 40 | 41 | ; | 37 | 38 | 37 |
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| 6. | 17 | 18 | 16 | ; | 17 | 17 | 17 |
| 7. | 17 | 16 | 17 | ; | 18 | 16 | 17 |
| 8. | 13 | 13 | 15 | ; | 15 | 14 | 14 |
| 9. | 47 | 47 | 48 | ; | 50 | 47 | 48 |
| 10. | 40 | 45 | 46 | ; | 43 | 52 | 56 |
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| 11. | 10.5 | ; | 12.5 | | | | |
| 12. | 15 | ; | 16.5 | | | | |
| 13. | 14.5 | ; | 16 | | | | |
| 14. | 10 | ; | 10 | | i. | | |
| 15. | 14.5 | ; | 15.5 | | | | |
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| 17. | 50 | ; | 64 | | | | |
| 18. | 54 | ; | 57 | | | | |

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| l. | 55 | 51 | 54 | ; | 52 | 51 | 49 |
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| 2. | 43 | 41 | 41 | ; | 39 | 38 | 38 |
| 3. | 39 | 40 | 39 | ; | 36 | 38 | 37 |
| 4. | 74 | 79 | 69 | ; | 66 | 67 | 68 |
| 5. | 46 | 44 | 46 | ; | 40 | 41 | 36 |
| 6. | 19 | 21 | 18 | ; | 20 | 18 | 20 |
| 7. | 16 | 15 | 19 | ; | 19 | 19 | 17 |
| 8. | 14 | 15 | 15 | ; | 14 | 15 | 14 |
| 9. | 49 | 51 | 52 | ; | 53 | 52 | 51 |
| 10. | 50 | 49 | 55 | ; | 44 | 57 | 59 |
| 11. | 10.5 | ; | 12 | | | | |
| 12. | 15 | ; | 16.5 | | | | |
| 13. | 18 | ; | 18 | | | | |
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| 15. | 11.5 | ; | 14.5 | | | | |
| 16. | 17 | ; | 14 | | | | |
| 17. | 56 | ; | 52 | | | | |
| 18. | 54 | ; | 40 | | | | |

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| 1. | 56 | 51 | 52 | ; | 52 | 51 | 52 |
| 2. | 51 | 43 | 42 | ; | 42 | 40 | 40 |
| 3. | 41 | 41 | 44 | ; | 41 | 41 | 43 |
| 4. | 67 | 66 | 64 | ; | 60 | 60 | 63 |
| 5. | 36 | 36 | 35 | ; | 36 | 35 | 37 |
| 6. | 16 | 18 | 19 | ; | 1.8 | 21 | 22 |
| 7. | 15 | 17 | 18 | ; | 17 | 18 | 18 |
| 8. | 13 | 14 | 14 | ; | 14 | 16 | 16 |
| 9. | 44 | 49 | 51 | ; | 49 | 55 | 56 |
| 10. | 45 | 49 | 45 | ; | 49 | 53 | 50 |
| 11. | 18 | ; | 14 | | | | |
| 12. | 16 | ; | 19 | | | | |
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| 15. | 16 | ; | 17 | | | | |
| 16. | 17.5 | ; | 15 | | | | |
| 17. | 57 | ; | 59 | | | | |
| 18. | 57 | ; | 50 | | | | |

| 1. | 73 | 67 | 66 | ; | 63 | 67 | 61 |
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| 2. | 60 | 53 | 57 | ; | 62 | 52 | 53 |
| 3. | 56 | 53 | 51 | ; | 45 | 49 | 47 |
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| 5. | 55 | 51 | 52 | ; | 50 | 55 | 60 |
| 6. | 15 | 17 | 17 | ; | 16 | 19 | 16 |
| 7. | 16 | 17 | 17 | ; | 14 | 14 | 14 |
| 8. | 12 | 12 | 13 | ; | 12 | 13 | 12 |
| 9. | 43 | 46 | 47 | ; | 42 | 46 | 42 |
| 10. | 41 | 45 | 40 | ; | 45 | 42 | 43 |
| 11. | 11 | ; | 14 | | | | |
| 12. | 13 | ; | 17 | | | | |
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| 2. | 49 | 50 | 48 | ; | 46 | 46 | 46 | |
| 3. | 45 | 47 | 43 | ; | 44 | 43 | 40 | |
| 4. | 81 | 75 | 83 | ; | 70 | 72 | 76 | |
| 5. | 43 | 47 | 41 | ; | 37 | 41 | 40 | |
| 6. | 16 | 17 | 14 | ; | 16 | 18 | 17 | |
| 7. | 13 | 14 | 13 | ; | 16 | 16 | 16 | |
| 8. | 12 | 12 | 13 | ; | 14 | 14 | 14 | |
| 9. | 41 | 43 | 40 | ; | 46 | 48 | 47 | |
| 10. | 45 | 43 | 45 | ; | 44 | 46 | 46 | |
| 11. | 16.5 | ; | 15 | | | | | |
| 12. | 15.5 | ; | 18 | | | | | |
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| 16. | 14 | • ; | 19 | | | | | |
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| 18. | 52 | ; | 47 | | | | | |

| 1. | 54 | 50 | 49 | ; | 53 | 51 | 51 |
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| 2. | 43 | 38 | 40 | ; | 42 | 40 | 37 |
| 3. | 35 | 36 | 39 | ; | 34 | 35 | 34 |
| 4. | 67 | 61 | 67 | ; | 63 | 68 | 63 |
| 5. | 38 | 41 | 41 | ; | 39 | 39 | 41 |
| 6. | 19 | 20 | 18 | ; | 19 | 20 | 22 |
| 7. | 19 | 18 | 18 | ; | 19 | 19 | 19 |
| 8. | 14 | 16 | 15 | ; | 13 | 17 | 16 |
| 9. | 52 | 54 | 51 | ; | 51 | 56 | 57 |
| 10. | 45 | 44 | 52 | ; | 41 | 42 | 43 |
| 11. | 14.5 | ; | 9.5 | | | | |
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| 2. | 50 | 42 | 41 | ; | 39 | 39 | 39 |
| 3. | 45 | 43 | 43 | ; | 47 | 41 | 43 |
| 4. | 74 | 75 | 75 | ; | 68 | 70 | 73 |
| 5. | 43 | 42 | 47 | ; | 44 | 41 | 41 |
| 6. | 17 | 17 | 18 | ; | 16 | 17 | 18 |
| 7. | 16 | 17 | 16 | ; | 16 | 19 | 15 |
| 8. | 12 | 13 | 13 | ; | 13 | 13 | 14 |
| 9. | 45 | 47 | 47 | ; | 45 | 49 | 47 |
| 10. | 42 | 48 | 49 | ; | 45 | 44 | 52 |
| 11. | 9.5 | ; | 11 | | | | |
| 12. | 14 | ; | 15.5 | | | | |
| 13. | 19 | ; | 18 | | | | |
| 14. | 9.5 | ; | 12.5 | | | | |
| 15. | 12 | ; | 15 | | | | |
| 16. | 16.5 | ; | 18 | | | | |
| 17. | 63 | ; | 49 | | | | |
| 18. | 56 | ; | 46 | | | | |

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| l. | 56 | 52 | 51 | ; | 50 | 49 | 51 |
| 2. | 40 | 42 | 36 | ; | 42 | 38 | 38 |
| 3. | 42 | 38 | 37 | ; | 38 | 38 | 41 |
| 4. | 75 | 68 | 70 | ; | 67 | 66 | 65 |
| 5. | 38 | 38 | 37 | ; | 38 | 38 | 34 |
| 6. | 19 | 20 | 20 | ; | 21 | 22 | 20 |
| 7. | 19 | 18 | 17 | ; | 16 | 18 | 19 |
| 8. | 14 | 13 | 16 | ; | 16 | 16 | 17 |
| 9. | 52 | 51 | 53 | ; | 53 | 56 | 56 |
| 10. | 52 | 53 | 52 | ; | 55 | 61 | 56 |
| 11. | 13 | ; | 14 | | | | |
| 12. | 18 | ; | 19 | | | | |
| 13. | 20.5 | ; | 20 | | | | |
| 14. | 11.5 | ; | 13.5 | | | | |
| 15. | 14.5 | ; | 18 | | | | |
| 16. | 14.5 | ; | 19.5 | | | | |
| 17. | 59 | ; | 60 | | | | |
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| 1. | 70 | 60 | 61 | ; | 56 | 56 | 56 |
| 2. | 56 | 48 | 46 | ; | 48 | 42 | 42 |
| 3. | 46 | 47 | 47 | ; | 44 | 42 | 43 |
| 4. | 65 | 64 | 62 | ; | 64 | 62 | 63 |
| 5. | 48 | 43 | 38 | ; | 42 | 43 | 40 |
| 6. | 18 | 17 | 18 | ; | 17 | 19 | 19 |
| 7. | 16 | 19 | 18 | ; | 15 | 17 | 20 |
| 8. | 14 | 14 | 15 | ; | 16 | 14 | 13 |
| 9. | 48 | 50 | 51 | ; | 48 | 50 | 52 |
| 10. | 43 | 47 | 46 | ; | 48 | 47 | 52 |
| 11. | 9 | ; | 11 | | | | |
| 12. | 14.5 | ; | 14 | | | | |
| 13. | 17.5 | ; | 18 | | | | |
| 14. | 7 | ; | 10 | | | | |
| 15. | 15.5 | ; | 17 | | | | |
| 16. | 13 | ; | 21 | | | | |
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| 18 | 52 | • | 42 | | | | |
| 10. | 52 | , | | | | | |
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| 1. | 65 | 61 | 61 | ; | 57 | 56 | 56 |
| 2. | 49 | 46 | 47 | ; | 41 | 43 | 39 |
| 3. | 48 | 46 | 49 | ; | 44 | 43 | 45 |
| 4. | 75 | 72 | 78 | ; | 65 | 66 | 68 |
| 5. | 44 | 45 | 41 | ; | 38 | 37 | 38 |
| c | 16 | 1 <i>7</i> 7 | 15 | | 17 | 10 | 10 |
| ь. | 10 | 17 | 15 | ; | 1/ | 10 | 10 |
| 7. | 15 | 14 | 15 | ; | 17 | 15 | 17 |
| 8. | 13 | 12 | 14 | ; | 13 | 13 | 13 |
| 9. | 44 | 43 | 44 | ; | 47 | 46 | 48 |
| 10. | 45 | 49 | 47 | ; | 49 | 48 | 54 |
| 11. | 13 | ; | 12 | | | | |
| 12. | 17 | ; | 12.5 | | | | |
| 13. | 14.5 | ; | 22 | | | | |
| 14. | 14 | ; | 12.5 | | | | |
| 15. | 15.5 | ; | 14 | | | | |
| 16. | 15 | ; | 16 | | | | |
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| 17. | 66 | ;, | 55 | | | | |
| 18. | 52 | ; | 51 | | | | |

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| 1. | 62 | 57 | 55 | ; | 54 | 54 | 54 |
| 2. | 51 | 48 | 43 | ; | 45 | 41 | 41 |
| 3. | 45 | 46 | 44 | ; | 45 | 43 | 43 |
| 4. | 70 | 76 | 81 | ; | 71 | 71 | 68 |
| 5. | 42 | 39 | 41 | ; | 42 | 41 | 38 |
| 6. | 17 | 19 | 20 | ; | 20 | 20 | 19 |
| 7. | 16 | 17 | 16 | ; | 17 | 16 | 18 |
| 8. | 13 | 14 | 13 | ; | 13 | 14 | 15 |
| 9. | 46 | 50 | 49 | ; | 50 | 50 | 52 |
| 10. | 42 | 45 | 49 | ; | 44 | 45 | 44 |
| 11. | 13 | ; | 13 | | | | |
| 12. | 17.5 | ; | 21 | | | | |
| 13. | 20 | ; | 18 | | | | |
| 14. | 10.5 | ; | 8 | | | | |
| 15. | 15 | ; | 16.5 | | | | |
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| 1. | 72 | 71 | 71 | ; | 65 | 68 | 65 |
| 2. | 54 | 55 | 54 | ; | 52 | 49 | 49 |
| 3. | 52 | 51 | 50 | ; | 50 | 48 | 49 |
| 4. | 80 | 89 | 89 | ; | 73 | 73 | 78 |
| 5. | 55 | 58 | 58 | ; | 52 | 51 | 52 |
| 6. | 15 | 14 | 17 | ; | 17 | 17 | 18 |
| 7. | 16 | 16 | 16 | ; | 14 | 14 | 16 |
| 8. | 13 | 12 | 13 | ; | 13 | 12 | 12 |
| 9. | 44 | 42 | 46 | ; | 44 | 43 | 46 |
| 10. | 35 | 33 | 36 | ; | 31 | 38 | 43 |
| 11. | 12 | ; | 14.5 | | | | |
| 12. | 15 | ; | 17.5 | | | | |
| 13. | 15.5 | ; | 16 | | | | |
| 14. | 10 | ; | 8 | | | | |
| 15. | 16.5 | ; | 16 | | | | |
| 16. | 14.5 | ; | 15 | | | | |
| 17. | 67 | ; | 66 | | | | |
| 18. | 76 | ; | 66 | | | | |

| | | | | Sub | ject | 26 | | |
|-----|------|----|---|-----|------|----|----|----|
| 1. | 60 | 54 | 5 | 4 | ; | 54 | 52 | 55 |
| 2 | 41 | 39 | 4 | 0 | ; | 41 | 39 | 40 |
| 3. | 43 | 42 | 4 | 6 | ; | 42 | 43 | 43 |
| 4. | 78 | 77 | 7 | 4 | ; | 71 | 72 | 70 |
| 5. | 41 | 39 | 4 | 0 | ; | 39 | 37 | 40 |
| | | | | | | | | |
| 6. | 18 | 19 | 1 | 9 | ; | 18 | 19 | 20 |
| 7. | 16 | 17 | 1 | 6 | ĵ | 15 | 16 | 14 |
| 8. | 14 | 14 | 1 | 4 | ; | 14 | 13 | 14 |
| 9. | 48 | 50 | 4 | 9 | ; | 47 | 48 | 48 |
| 10. | 52 | 56 | 5 | 2 | ; | 49 | 50 | 52 |
| | | | | | | | | |
| 11. | 8.5 | ; | 1 | 1.5 | | | | |
| 12. | 14 | ; | 1 | 4 | | | | |
| 13. | 18 | ; | 2 | 1 | | | | |
| 14. | 8.5 | ; | 1 | 0 | | | | |
| 15. | 11.5 | ; | l | .4 | | | | |
| 16. | 17.5 | ; | 1 | .5 | | | | |
| | | | | | | | | |
| 17. | 47 | ; | 4 | 5 | | | | |
| 18 | 44 | ; | 3 | 6 | | | | |

| 65 | 59 | 61 | ; | 57 | 56 | 56 |
|----|----|------|---|----|----|----|
| 55 | 47 | 50 | ; | 44 | 47 | 47 |
| 45 | 45 | 43 | ; | 44 | 42 | 44 |
| 72 | 82 | 74 | ; | 74 | 71 | 65 |
| 46 | 42 | 42 | ; | 42 | 45 | 45 |
| | | | | | | |
| 13 | 13 | 14 | ; | 13 | 16 | 15 |
| 16 | 21 | 20 | ; | 17 | 18 | 18 |
| 12 | 13 | 10 | ; | 11 | 12 | 13 |
| 41 | 47 | 44 | ; | 41 | 46 | 46 |
| 40 | 34 | 33 | ; | 38 | 33 | 36 |
| | | | | | | |
| 17 | ; | 19 | | | | |
| 30 | ; | 28 | | | | |
| 28 | ; | 26.5 | | | | |

19.5

28.5

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Subject 27

1.

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| 1. | 58 | 54 | 53 | ; | 60 | 55 | 57 |
|-----|-----|----|------|---|----|----|----|
| 2. | 54 | 46 | 46 | ; | 50 | 43 | 49 |
| 3. | 42 | 45 | 46 | ; | 44 | 43 | 43 |
| 4. | 69 | 69 | 68 | ; | 66 | 66 | 71 |
| 5. | 39 | 38 | 37 | ; | 41 | 37 | 37 |
| 6. | 16 | 18 | 18 | ; | 18 | 18 | 16 |
| 7. | 15 | 14 | 16 | ; | 16 | 16 | 16 |
| 8. | 14 | 13 | 13 | ; | 13 | 15 | 14 |
| 9. | 45 | 45 | 47 | ; | 47 | 49 | 46 |
| 10. | 45 | 43 | 43 | ; | 41 | 46 | 39 |
| 11. | 7 | ; | 8.5 | | | | |
| 12. | 13 | ; | 13 | | | | |
| 13. | 9.5 | ; | 10.5 | | | | |
| 14. | 7.5 | ; | 9 | | | | |
| 15. | 13 | ; | 13.5 | | | | |
| 16. | 13 | ; | 12 | | | | |
| 17. | 49 | 7 | 36 | | | | |
| 18. | 34 | ;; | 34 | | | | |

Subject 28

| 1. | 57 | 53 | 55 | ; | 52 | 47 | 54 |
|-----|------|----|------|---|----|----|----|
| 2. | 40 | 39 | 38 | ; | 40 | 38 | 39 |
| 3. | 55 | 55 | 40 | ; | 42 | 39 | 41 |
| 4. | 79 | 72 | 76 | ; | 70 | 77 | 76 |
| 5. | 43 | 49 | 43 | ; | 42 | 40 | 41 |
| 6. | 18 | 18 | 19 | ; | 19 | 19 | 20 |
| 7. | 18 | 16 | 17 | ; | 17 | 18 | 18 |
| 8. | 15 | 16 | 14 | ; | 16 | 14 | 16 |
| 9. | 51 | 50 | 50 | ; | 52 | 51 | 54 |
| 10. | 44 | 43 | 50 | ; | 50 | 51 | 55 |
| 11. | 15.5 | ; | 16 | | | | |
| 12. | 17.5 | ; | 17 | | | | |
| 13. | 19 | ; | 20.5 | | | | |
| 14. | 8.5 | ; | 9.5 | | | | |
| 15. | 14 | ; | 13.5 | | | | |
| 16. | 15 | ; | 17 | | 0 | | |
| 17. | 63 | ; | 57 | | | | |
| 18. | 57 | ; | 52 | | | | |

Subject 29

| | | | Sul | oject 3 | 30 | | |
|-----|------|----|-----|---------|----|----|----|
| 1. | 67 | 62 | 59 | ; | 59 | 57 | 56 |
| 2. | 45 | 43 | 43 | ; | 44 | 41 | 40 |
| 3. | 48 | 45 | 45 | ; | 44 | 44 | 42 |
| 4. | 72 | 73 | 68 | ; | 68 | 67 | 67 |
| 5. | 39 | 39 | 36 | ; | 35 | 45 | 37 |
| 6. | 16 | 17 | 16 | ; | 16 | 17 | 19 |
| 7. | 17 | 18 | 20 | ; | 18 | 20 | 18 |
| 8. | 14 | 14 | 16 | ; | 16 | 16 | 15 |
| 9. | 47 | 49 | 52 | ; | 50 | 53 | 22 |
| 10. | 51 | 48 | 49 | ; | 46 | 48 | 49 |
| 11. | 10.5 | ; | 9 | | | | |
| 12. | 17.5 | ; | 18 | | | | |
| 13. | 17 | ; | 15 | | ¢ | | |
| 14. | 10.5 | ; | 11 | | | | |
| 15. | 15.5 | ; | 16 | | | | |
| 16. | 14 | ; | 16 | | | | |
| 17. | 80 | ; | 66 | | | | |
| 18. | 73 | ; | 60 | | | | |

| 60 | |
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| | |

Subject 31*

| 1. | 60 | 60 | 59 | ; | 56 | 57 | 57 |
|-----|------|----|------|---|----|----|----|
| 2. | 45 | 43 | 39 | ; | 40 | 38 | 38 |
| 3. | 45 | 45 | 45 | ; | 46 | 45 | 44 |
| 4. | 70 | 67 | 71 | ; | 74 | 61 | 63 |
| 5. | 40 | 39 | 38 | ; | 37 | 36 | 38 |
| 6. | 15 | 16 | 15 | ; | 18 | 19 | 17 |
| 7. | 15 | 16 | 17 | ; | 18 | 16 | 18 |
| 8. | 13 | 13 | 14 | ; | 13 | 14 | 13 |
| 9. | 43 | 45 | 46 | ; | 49 | 49 | 48 |
| 10. | 43 | 50 | 49 | ; | 46 | 49 | 47 |
| 11. | 12 | ; | 12 | | | | |
| 12. | 18.5 | ; | 18 | | | | |
| 13. | 17.5 | ; | 18.5 | | | | |
| 14. | 10.5 | ; | 11.5 | | | | |
| 15. | 16 | ; | 17 | | | | |
| 16. | 18 | ; | 17 | | | | |
| 17. | 66 | ; | 59 | | | | |
| 18. | 62 | ; | 50 | | | | |
| | | | | | | | |

*The only left hand dominant subject.

APPENDIX B

Consent Form TEXAS WOMAN'S UNIVERSITY HUMAN SUBJECTS REVIEW COMMITTEE

(Form B)

Title of Project:

Consent to Act as A Subject for Research and Investigation:

I have received an oral description of this study, including a fair explanation of the procedures and their purpose, any associated discomforts or risks, and a description of the possible benefits. An offer has been made to me to answer all questions about the study. I understand that my name will not be used in any release of the data and that I am free to withdraw at any time. I further understand that no medical service or compensation is provided to subjects by the university as a result of injury from participation in research.

Signature

Date

Witness

Date

Certification by Person Explaining the Study:

Date

This is to certify that I have fully informed and explained to the above named person a description of the listed elements of informed consent.

Signature

Date

Position

Witness

One copy of this form, signed and witnessed, must be given to each subject. A second copy must be retained by the investigator for filing with the Chariman of the Human Subjects Review Committee. A third copy may be made for the investigator's files,

APPENDIX C

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INDIVIDUAL RECORD FORM

| v | | - | | DJA: | | | | |
|---|---------|-------------|-------------|-----------|-------------|-----------|----------|-------|
| | | | | | YAME: | | | |
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| Palm, | | | | Tir. | ļ | | | |
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| 3-0. | | | | 3-p. | | | | |
| | LEF | т | | | | LEFT | | |
| Palm. | | | | Tip. | | | | |
| Lat. | | | | Lat. | | | | |
| 3-0. | | | | j-n. | | | ~ | |
| at an | | 7 | CHER JA | - A.S. D. | AT AM ALCOR | | | |
| 1st | 2n | d _ | Highe | st | 1st | 2nd | High | est |
| Rt. | | | | Rt. | | | | |
| T.+ | | | | T.+ | - | | | |
| | | | | - | | | | |

APPENDIX D

| | SCALES | | | GR | DU'P FING | | | | IND | IVID | UAL | TE | STIN | G (To | otal se | cond | s by | test) | | | |
|--------------|---------|----------|--------------|------------|---------------|------------|-------------|------------|-------------------------------|-------------------------------|------------|------------|------------|-------------------------------|-------------------------------|------------|----------|--------------|-------------------------------|-------------------------------|------------|
| | | | | 4 tr | ials onds) | | F | ourt | rials | | | | Three | e trials | 5 | | | Twot | rials | | |
| VERBAL | STANINE | STANDARD | PERCENTILE | Placing | 'Furning | Placing | Turning | Displacing | 1 Mand Turning and Placing | 2-Hand Turning and Placing | Placing | Turnuy | Displacing | 1 Hand Turning and Placing | 2 Hand Furning and Placing | Placing | Turning | Displacing | 1 Hand Turning and Placing | 2-Hand Furning and Placing | AVERACE |
| | | | 99- | 193 | 150 | 199 | 154 | 153 | 230 | 126 | 149 | 116 | 115 | 173 | 96 | 100 | 77 | 79 | 116 | 65 | 99 |
| Very high | 9 | - 70 | 98 - 97 - | 197 201 | 156 155 | 204 207 | 158 161 | 157 160 | 239 241 | 132 135 | 153 156 | 119 121 | 118 120 | 189 184 | 100 102 | 102 104 | 80 81 | 81 82 | 120 123 | 69 | 95 97 |
| | | | 05. | 205 | 164 | 212 | 165 | 164 | 251 | 140 | 169 | 125 | 123 | 189 | 106 | 107 | 84 | 84 | 127 | 71 | 95 |
| | | 65 | 30. | 203 | 104 | 211 | 100 | 101 | | 110 | 100 | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | 90. | 211 | 170 | 218 | 171 | 108 | 262 | 146 | 164 | 129 | 126 | 197 | m | 110 | 87 | | 177 | 15 | 90 |
| lich | 7 | 60- | 85 - | 215 | 175 | 223 | 175 | 172 | 269 | 151 | 168 | 132 | 129 | 203 | 114 | 113 | 89 | 85 | 136 | 77 | 85 |
| 1 | | - | 80 - | 219 | 178 | 227 | 178 | 175 | 276 | 155 | 171 | 135 | 131 | 208 | 117 | 115 | 91 | 89 | 139 | 79 | R 0 |
| | | | 75 - | 222 | 181 | 234) | 181 | 178 | 281 | 158 | 173 | 137 | 133 | 212 | 119 | 115 | 93 | 90 | 142 | 81 | 75 |
| | 6 | 65 | 6 9 · | 225 | 184 | 733 | 184 | 040 | 150 | 161 | 176 | 130 | 175 | 216 | 172 | 117 | 94 | (10) | 116 | 82 | 69 |
| e y | | | E0 - | 230 | 188 | 258 | 158 | 184 | 293 | 166 | 179 | 143 | 138 | 221 | 125 | 121 | 97 | 93 | 149 | 85 | 60 |
| Avern | 5 | 50- | 50. | 256 | 195 | 242 | 192 | 189 | 301 | 171 | 153 | 146 | 142 | 227 | 129 | 123 | 99 | 95 | 153 | 87 | 50 |
| | | - | 40 - | 243 | 201 | 246 | 197 | 195 | 309 | 175 | 187 | 149 | 146 | 233 | 132 | 126 | 101 | 9 6 | 157 | 89 | 40 |
| | 4 | 45 - | 31 - | 245 | 207 | 252 | 201 | 199 | 316 | 180 | 190 | 152 | 149 | 239 | 136 | 128 | 104 | 9 8 | 160 | 92 | 31 |
| | | | 25 - | 251 | 212 | 255 | 203 | 203 | 321 | 183 | 193 | 155 | 152 | 243 | 138 | 130 | 105 | 89 | 163 | 93 | 25 |
| . 3 | | | 20 - | 256 | 217 | 258 | 206 | 207 | 327 | 187 | 195 | 157 | 155 | 246 | 141 | 132 | 107 | 100 | 166 | 95 | 20 |
| <u> </u> | 3 | 40 - | 15- | 261 | 223 | 262 | 210 | 211 | 333 | 190 | 198 | 160 | 158 | 251 | 144 | 134 | 109 | 101 | 169 | 97 | 15 |
| | | | 10- | 267 | 230 | 206 | 214 | 216 | 340 | 195 | 202 | 163 | 162 | 257 | 147 | 135 | 111 | 103 | 173 | 99 | 10 |
| | 2 | 35- | | | | | | | | | | | | | | | | | | | |
| | | - | 5. | 279 | 243 | 273 | 2 20 | 229 | 351 | 202 | 207 | 167 | 172 | 265 | 152 | 140 | 114 | 106 | 179 | 102 | 5 |
| low | ĺ | | 3- | 286 | 253 | 276 | 224 | 239 | 358 | 206 | 210 | 170 | 179 | 270 | 156 | 142 | 116 | 107 | 182 | 105 | 3 |
| Very | 1 | 30 | 2. | 293 | 260 | 251 | 226 | 244 | 3 64 | 210 | 213 | 173 | 183 | 274 | 158 | 144 | 118 | 108 | 185 | 106 | 2 |
| | | - | 1. | 302 | 265 | 286 | 231 | 2+;0 | 372 | 215 | 217 | 176 | 195 | 2×1 | 162 | 147 | 121 | 110 | 189 | 109 | 1 |

MINNESOTA RATE OF MANIPULATION TEST -- INTERPRETATION CHART

APPENDIX E

| | 1 | r | | | | | | 0.0 | | | | | | 1 |
|-----|------|----------|----------|----------|----------|----------|----------|---------|----------|------|------|-------|--------|------|
| | | RIGHT | HAND | IFFT | HAND | BOTH | HANDS | B BOTH | HANDS | 1.4 | SEM | A Y | | |
| | | HOUS | TRIAL | INDUS | TRIA | INCUS | TRIAL | INDUS | TRIAL | INC | 15 | ICOLI | 1.1 | |
| | | APPLICAN | TS AND | APPLICAN | TS AND | APPLICAN | TS AND | APPLICA | NTS AND | 191 | L AM | 110 | DENTS | |
| | | COLLEGE | STUDENTS | COLLEGE | STUDENTS | COLLEGE | STUCENTS | COLLEGE | STUDENTS | PLIC | ANIS | | | 1 |
| | | 3 | 3 | 4 | | - | 2 | 1 1 | 3 | - | 5 | 1 - | 5 | |
| | | - 2 | "2 | | | | 2 | | | | 2 | | | |
| | | | + | F | F | - | F | - | + | - | | | - | 1 |
| | 99 | - 21 | | - 20 | | - 18 | - | - 54 | 180 - | 1 30 | 158 | 1 50 | 1:59 - | - 99 |
| | | | | | 62 | | | | 179 | | 157 | 1 | 157 | 1 |
| | | | • • • | | | | | 47 | 178 | | 156 | 1 | 1.4.6 | 1 |
| | | | | | 61 | 17 | 34 | | 177 | ., | | 40 | | 1 |
| | | | | | | | 53 | | 176 | | 154 | 1 | | ł |
| | | | | | | | 82 | | 175 | | 153 | | 134 | [|
| | | | 64 | | 60 | | | 30 | 174 | ** | 1.4 | | 153 | 1 |
| | | | | | | | 31 | | 173 | | | 48 | 152 | 1 |
| | | | | 13 | | | | 55 | 171 | 47 | 140 | | 1.51 | 4 |
| | | | 1 | | | 16 | | | 170 | 1 | 144 | 1 | | 1 |
| | 95 | - | 63 - | | - | - | - | | 169 - | t | 147 | | 1.4.9 | -95 |
| | | | | | 58 | | 49 | 24 | 168 | 48 | | 47 | | 1 |
| | | 20 | | | | | | | 187 | | 144 | | | Ļ |
| | | | 1 42 | | 57 | | | | 166 | 45 | 143 | | 46 | ļ. |
| | | | | | | | 48 | 53 | | | 141 | | | ł |
| | 90 | - | - | - " | | - | - | - | | 44 | 140 | | 149 - | -90 |
| | 1 | | 61 | | | | | | 164 | | 134 | 1 | 144 | 1 |
| | • | | | | | | | | 163 | 43 | 157 | 45 | 143 | ł |
| | 1 | , X | 60 | | | | 47 | 52 | | | 130 | 1 | 142 | t |
| | 1 | 19 | | | | 15 | | | 102 - | 42 | 134 | | 141 | Ŧ |
| | 1 | | | | | | | | 161 | | 133 | 44 | 140 | t |
| | | L | 59 | | | | | | 160 | 41 | 131 | | 133 | 1 an |
| | 00 | | | | 54 | ~ | | 51 | 159 | | 129 | | 138 | 100 |
| | | | 5.6 | | | | | | 158 | 40 | 128 | • 3 | 134 | ŧ |
| | - | - | - | - 17 | | - | 45 - | - | | - | 127 | | 135 | 1 |
| | 1 | | | | 53 | | | 50 | 157 | | 178 | 42 | 194 | ŧ |
| | 70 | - | 97 _ | | | - | - | - | 130 - | | 123 | | 111- | 70 |
| 141 | | | | | | | | | 154 | | 123 | | 132 | ł |
| = | - | | 86 - | - | •2 - | · / | 44 - | 49 | 153 | 38 | 122 | • 1 | - | ÷ |
| z | 1 | | | | | 14 | | | 152 | | 121 | | 129 | ł |
| 5 | 60 - | - · · | - | | | - | - | - | 151 | - | 119 | 42 | 129 | 60 |
| 2 | | | \$5 | | . 37 | | 43 | 48 | 150 | 37 | 118 | 1.0 | | ŧ |
| ũ | | - | | 16 | | | | | 149 | F | 117 | | 127 - | ŧ. |
| ۵. | 50 | L | | | 50 _ | _ | | | H8 - | 36 | 115 | | 126 | 150 |
| | 30 7 | | 54 | | | 1 C C C | 42 | 47 | 147 | | 114 | 33 | 125 | 1.0 |
| | 1 | L | | | | _ | _ | - | 145 - | 33 | 113 | | 124 | ŧ. |
| | - | | | | 49 | | | | | | 111 | | 123 | Ŧ |
| | 40 | - | 53 - | - | - | - 1 | 41 - | 46 | | 1.34 | 109 | 38 | 122- | 40 |
| | | | | | | 13 | | | 144 | | 100 | | 121 | \$ |
| | - | - | 52 - | - 1 | 48 | - | - | - | 143 - | | 106 | | 120- | ŧ |
| | 1 | | | | | | 40 | 43 | 142 | 32 | 105 | 37 | 119 | ŧ |
| | 30 - | - | 51 | - 15 | - | - | - | | 141 - | - | 103 | | | = 30 |
| | | | | | 47 | | | | 40 | 31 | 101 | 30 | 115 | ŧ |
| | | - " | - | - | - | - | 39 - | | 139 - | - | 100 | 35 | 113- | Ŧ |
| | | ł | 50 | | | | | | 138 | 30 | 99 | 1 | 112 | 1 |
| | - | Ł | | | | | _ | - | 137 | L | 97 | 34 | 110 | 120 |
| | 20 | I | 47 | | | | | 43 | 136 | 2. | 96 | | 109 | 1 20 |
| | | ł | | | 45 | | 38 | | 135 | | 94 | 33 | 106 | ł |
| | 1 | - | - 1 | + | - | - 12 | - | - | 154 - | 28 | 92 | 1 | 105- | + |
| | | 1 | 40 | 14 | 44 | | | 42 | 133 | 1.0 | 91 | 32 | 104 | 1 |
| | | 15 | | | | | 37 | | 152 | | 89 | | 103 | ł |
| | | ł | 47 | | | | | | 131 | 21 | 88 | | 101 | t |
| | 10- | - | | | | - | - | - | 130 | | 1 .7 | 31 | 100 | 10 |
| | | 1 | | | •, | | 36 | 41 | 129 | 26 | | | 99 | 1 |
| | | I | 46 | | | | | | | | 84 | 30 | 98 | 1 |
| | | | | × | 42 | | | | 124 | 25 | 83 | | 97 | [|
| | | 1 | 45 | | | | 35 | | 127 | | 82 | | 96 | 1 |
| | 5 - | - 14 | | - 13 | | - 11 | - | - 40 | 126 - | 5. | 60 | 29 | 1 95 - | 1 5 |
| | | | 44 | | 41 | | | | 125 | 1 | 79 | | H | 1 |
| | | | | | | | 34 | | 124 | | 78 | | 93 | |
| | | 1 | | | 40 | | 33 | 39 | 123 | 23 | 77 | 2.5 | 91 | ł |
| | | 1 | | | | | | | 122 | | 75 | | | 1 |
| | | | 43 | | | 10 | 32 | 34 | 120 | 12 | 74 | 27 | 64 | 1 |
| | 1 | 1 | | | 30 | | 31 | | 112 | | 172 | | 87 | [|
| | | | | | | | 30 | 37 | 117 | | 10 | 26 | | 1 |
| | | | | | ., | | ~ | . 1 | | | | | 83 | 1 |
| | | L " | | . " | | | 20 | . 24 | 1:4 | - | | | | ι. |
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Purdue Pegboard Raw Score--Percentile Conversion Table for Woman

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APPENDIX F

DYNAMOMETER - FEMALE

(Pounds Pressure)

| Age Croup | L | | | | | | | | | | | |
|---------------|-----|------|-----|------|----|------|-----|----------|-----|------|--|--|
| | 101 | 10th | | 25th | | 50th | | . 75th . | | 90th | | |
| | | Hand | | | | | | | | | | |
| | R | L | R | L | R | L | · R | L | R | L | | |
| 20-24 | 48 | 41 | 55 | 49 | 62 | 57 | 70 | 64 | 77 | 71 | | |
| 25-29 | 46 | 39 | 53 | 47 | 61 | 55 | 68 | 62 | 75 | 70 | | |
| 30-34 | 45 | 38 | 51 | 46 | 60 | 54 | 67 | 61 | 74 | 68 | | |
| 35-3 9 | 43 | 35 | 50 | 44 | 58 | 52 | 65 | 60 | 72 | 67 | | |
| 40-44 | 41 | 35 | 48 | 43 | 56 | 50 | 64 | 58 | 71 | 65 | | |
| 45-49 | 40 | 33 | 47 | 41 | 55 | 49 | 62 | 57 | 69 | 64 | | |
| 50-54 | 38 | 32 | 45. | 40 | 53 | 48 | 60 | 55 | 67 | 62 | | |
| 55- 59 | 37 | 30 | 44 | 38 | 51 | 46 | 59 | 54 | 66 | 61 | | |
| 60-64 | 35 | 29 | 42 | 37 | 50 | 45 | 57 | 52 | 64 | 59 | | |
| 65-69 | 33 | 27 | 40 | 35 | 48 | 43 | 55 | 51 | 63 | 58 | | |
| 70-74 | 32 | 26 | 39 | 34 | 46 | 41 | 54 | 50 | 61 | 56 | | |
| 75- 79 | 30 | 24 | 37 | 32 | 45 | 40 | 52 | 48 | 60 | 55 | | |
| 80-84 | 29 | 23 | 36 | 31 | 43 | .39 | 50 | 46 | 58. | 54 | | |

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APPENDIX G

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OSCO PINCH METER

PALMER PINCH - FEMALE

(Pounds Pressure)

| ************************************** | Percentile | | | | | | | | | | | |
|--|------------|------|------|------|------|------|------|------|------|------|--|--|
| Age Group | 10th | | 25th | | 50th | | 75th | | 901h | | | |
| | Hend | | | | | | | | | | | |
| _ | R | L | R | L | R | L | R | L | R | L | | |
| 20-24 | 10.5 | 10.0 | 12.5 | 12.0 | 15.0 | 14.0 | 17.0 | 16.0 | 19.0 | 18.5 | | |
| 25-29 | 10.0 | 9.5 | 12.0 | 11.5 | 14.5 | 13.5 | 16.5 | 15.5 | 18.5 | 18.0 | | |
| 30-34 | 9.5 | 9.0 | 11.5 | 11.0 | 14.0 | 13.0 | 16.0 | 15.0 | 18.0 | 17.5 | | |
| 35-39 | 9.0 | 8.0 | 11.0 | 10.5 | 13.5 | 12.5 | 15.5 | 14.5 | 17.5 | 17.0 | | |
| 40-44 | 8.5 | 7.5 | 10.5 | 10.0 | 13.0 | 12.0 | 15.0 | 14.0 | 17.0 | 16.0 | | |
| 45-49 | 8.0 | 7.0 | 10.0 | 9.0 | 12.5 | 11.5 | 14.5 | 13.5 | 16.0 | 15.5 | | |
| 50-54 | 7.5 | 6.5 | 9.5 | 8.5 | 11.5 | 10.5 | 14.0 | 13.0 | 15.5 | 15.0 | | |
| 55-59 | 7.0 | 6.0 | 9.0 | 8.0 | 11.0 | 10.0 | 13.5 | 12.5 | 15.0 | 14.5 | | |
| 60-64 | 6.0 | 5.0 | 8.5 | 7.5 | 10.5 | 9.5 | 12.5 | 11.5 | 14.5 | 14.0 | | |
| 65-69 | 5.5 | 4.5 | 7.5 | 7.0 | 10.0 | 9.0 | 12.0 | 11.0 | 14.0 | 13.0 | | |
| 70-74 | 5.0 | 4.0 | 7.0 | 6.0 | 9.5 | 8.5 | 11.5 | 10.5 | 13.5 | 12.5 | | |
| 75-79 | 4.5 | 3.5 | 6.5 | 5.5 | 9.0 | 7.5 | 11.0 | 10.0 | 13.0 | 12.0 | | |
| 80-84 | 4.0 | 3.0 | 6.0 | 5.0 | 8.5 | 7.0 | 10.5 | 9.0 | 12.5 | 11.5 | | |

LATTRAL PINCH - FEMALE

74

(Pounds Pressure)

| | Percentile | | | | | | | | | | | | |
|-------|------------|------|------|------|------|------|------|------|------|------|--|--|--|
| Age | 10th | | 25th | | 50th | | 75th | | 90th | | | | |
| Group | Hand | | | | | | | | | | | | |
| | R | L | R | L | R | L | R | L | R | L | | | |
| 20-24 | 10.5 | 10.0 | 12.0 | 11.5 | 14.0 | 13.5 | 16.0 | 15.5 | 17.5 | 17.0 | | | |
| 25-29 | 10.0 | 9.5 | 12.0 | 11.0 | 13.5 | 13.0 | 15.5 | 15.0 | 17.0 | 16.5 | | | |
| 30-34 | 9.5 | 9.0 | 11.5 | 11.0 | 13.5 | 12.5 | 15.0 | 14.5 | 17.0 | 16.5 | | | |
| 35-39 | 9.5 | 9.0 | 11.5 | 10.5 | 13.0 | 12.5 | 15.0 | 14.5 | 16.5 | 16.0 | | | |
| 40-44 | 9.0 | 8.5 | 11.0 | 10.0 | 13.0 | 12.0 | 14.5 | 14.0 | 16.0 | 15.5 | | | |
| 45-49 | 9.0 | 8.0 | 10.5 | 10.0 | 12.5 | 11.5 | 14.5 | 13.5 | 16.0 | 15.5 | | | |
| 50-54 | 8.5 | 7.5 | 10.5 | 9.5 | 12.0 | 11.5 | 14.0 | 13.5 | 15.5 | 15.0 | | | |
| 55-59 | 8.0 | 7.5 | 10.0 | 9.0 | 12.0 | 11.0 | 14.0 | 13.0 | 15.0 | 14.5 | | | |
| 60-64 | 8.0 | 7.0 | 10.0 | 8.5 | 11.5 | 10.5 | 13.5 | 12.5 | 15.0 | 14.5 | | | |
| 65-69 | 7.5 | 6.5 | 9.5 | 8.5 | 11.0 | 10.0 | 13.0 | 12.5 | 14.5 | 14.0 | | | |
| 70-74 | 7.5 | 6.5 | 9.0 | 8.0 | 11.0 | 10.0 | 13.0 | 12.0 | 14.5 | 13.5 | | | |
| 75-79 | 7.0 | 6.0 | 9.0 | 7.5 | 10.5 | 9.5 | 12.5 | 11.5 | 14.0 | 13.0 | | | |
| 80-84 | 7.0 | 5.5 | 8.5 | 7.5 | 10.5 | 9.0 | 12.5 | 11.5 | 14.0 | 13.0 | | | |

THREE-POINT PINCH--FEMALE

(Pounds Pressure)

| | Percentile | | | | | | | | | | | |
|---------------|------------|-----|------|------|------|------|------|------|------|------|--|--|
| Age | 10th | | 25th | | 50th | | 75th | | 90th | | | |
| Group | Hend | | | | | | | | | | | |
| · | R | L | R | L | R | L | R | L | R | L | | |
| 20-24 | 10.0 | 9.0 | 12.0 | 11.0 | 14.0 | 13.0 | 15.5 | 15.0 | 17.5 | 17.0 | | |
| 25-29 | 9.5 | 8.5 | 11.5 | 10.5 | 13.5 | 12.5 | 15.0 | 14.5 | 17.0 | 16.5 | | |
| 30-34 | 9.0 | 8.0 | 11.0 | 10.0 | 13.0 | 12.0 | 14.5 | 14.0 | 16.5 | 16.0 | | |
| 35-39 | 8.5 | 7.5 | 10.5 | 10.0 | 12.5 | 12.0 | 14.5 | 13.5 | 16.5 | 15.5 | | |
| 40-44 | 8.5 | 7.5 | 10.5 | 9.5 | 12.5 | 11.5 | 14.0 | 13.5 | 16.0 | 15.5 | | |
| 45-49 | 8.0 | 7.0 | 10.0 | 9.0 | 12.0 | 11.0 | 13.5 | 13.0 | 15.5 | 15.0 | | |
| 50-54 | 7.5 | 6.5 | 9.5 | 8.5 | 11.5 | 10.5 | 13.0 | 12.5 | 15.0 | 14.5 | | |
| 55-59 | 7.0 | 6.0 | 9.0 | 8.0 | 11.0 | 10.5 | 13.0 | 12.0 | 15.0 | 14.0 | | |
| 60-64 | 6.5 | 6.0 | 9.0 | 8.0 | 10.5 | 10.0 | 12.5 | 12.0 | 14.5 | 13.5 | | |
| 65-69 | 6.5 | 5.5 | 8.5 | 7.5 | 10.5 | 9.5 | 12.0 | 11.5 | 14.0 | 13.5 | | |
| 70- 74 | 6.0 | 5.0 | 8.0 | 7.0 | 10.0 | 9.0 | 12.0 | 11.0 | 13.5 | 13.0 | | |
| 75- 79 | 5.5 | 4.5 | 7.5 | 6.5 | 9.5 | 8.5 | 11.5 | 10.5 | 13.5 | 12.5 | | |
| 80-84 | 5.0 | 4.5 | 7.5 | 6.0 | 9.0 | 8.5 | 11.0 | 10.0 | 13.0 | 12.0 | | |

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