SW 430: Research Methods in Social Work I
Final Examination

1.21. When we use the Method of Intuition, we hold a belief because
   a. evidence from a systematic observation of events supports our belief better than it supports any other belief.
   b. holding the belief helps us avoid anxiety associated with not knowing.
   c. it was endorsed by someone who has been socially or politically defined as a qualified producer of knowledge
   d. the belief was deduced by strictly following the forms and rules of logical argument.
   e. the majority of a random sampling of sources says the belief is true.

1.80. When we work to maximize “good outcomes for science, humanity, and the individual research participants while avoiding or minimizing unnecessary, risk, harm, or wrong,” we are implementing which one of the following ethical principles.
   a. Beneficence
   b. Competence
   c. Comprehension
   d. Justice
   e. Respect

2.02. S.S. Stevens defined four levels of measurement used to classify measurement schemes: Nominal, Ordinal, Interval, and Ratio.
For each of the following, identify the level of measurement by writing Nominal, Ordinal, Interval, or Ratio in the space provided. Do NOT use initials.
   c. __________ Amount of household income above (positive numeral) or below (negative numeral) poverty level.
   e. __________ Body temperature in degrees Fahrenheit.
   g. __________ Classification of residence location (1 = rural, 2 = urban, or 3 = suburban).
   n. __________ Deviation score (\( y = Y - \mu_Y \)).
   y. __________ Number of days a case is open in intake.
   δ. __________ Rating of agreement with a statement about self (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = Neither agree nor disagree, 5 = slightly agree, 6 = agree, 7 = strongly agree).
3.12. The following are a set of 25 social competency scores. Present them in a grouped frequency table. The bottom interval should have a lower limit of zero (real lower limit of –0.5). The interval width should be \( i = 5 \).

\{23, 30, 32, 31, 28, 18, 7, 17, 32, 22, 25, 23, 21, 38, 25, 26, 3, 34, 23, 21, 20, 13, 36, 11, 27\}

The number of class intervals will be less than the number of spaces that the table provides.

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>Frequency</th>
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4.18 We typically set the criterion maximum probability of committing a Type I Error – \( P[\text{Type I Error}] \) – at \( \alpha = .05 \).

This implies that the criterion probability of not committing a Type I Error – \( P[\sim\text{Type I Error}] = 1 – P[\text{Type I Error}] \) – would be \( 1 – \alpha = .95 \).

We have evaluated the effectiveness of a program at two different times (conducted two distinct comparisons). On both occasions, we used a statistical hypothesis test at \( \alpha = .05 \) to evaluate the outcome data. Evaluate the following across these \( c = 2 \) comparisons.

4.18.1. Assuming that the Null Hypothesis is true, what is the probability that you will not commit a Type I Error on either or both of the \( c = 2 \) comparisons?

Please show your work and do not round your final answer.

\( (1 – \alpha)^c = \) ____________________

4.18.2. Assuming that the Null Hypothesis is true, what is \( \alpha_{\exp} \) (the experiment-wise \( \alpha \); the probability that you will commit a Type I Error on at least one of the \( c = 2 \) comparisons)?

Please show your work and do not round your final answer.

\( \alpha_{\exp} = \) ____________________
4.31. You have a sampling frame containing the names of $N = 5000$ individuals. You wish to draw a sample of $n = 5$ individuals. You assign consecutive identification numerals from 1 to 5000 to each of the individuals. Then you take a table of random digits and look at the last four digits of the random digits in the table. If the last four digits were greater than 5000, you would ignore that random digit.

| 03991 | For example, in the table of random digits to the left, you would read 03991 as 3991, 10461  |
| 10461 | as 0461, 20097 as 0097, 76794 as 6794, 23287 as 3287, 31630 as 1630, and 01272 as 1272. |
| 20097 | Since 6794 is greater than 5000, you would drop this number. |
| 76794 | You would use the remaining numerals select sampling units for inclusion in the sample. |
| 23287 | Thus, you would select those individuals from the population assigned numbers 3991, 461, |
| 31630 | 97, 3287, and 1630 for the sample. |
| 01272 | |

If you follow this procedure you have drawn a(n)

- a. purposive sample
- b. quota sample
- c. random sample
- d. stratified sample
- e. systematic sample

5.10 A characteristic of a population (such as average age) is called a(n) ________________ while the same characteristic of a sample is called ________________ .

5.20 The score ($Y$) in the following table represents the score on a social skills checklist.

<table>
<thead>
<tr>
<th>$Y$</th>
<th>$f$</th>
<th>$cf$</th>
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<tbody>
<tr>
<td>76-80</td>
<td>1</td>
<td>48</td>
</tr>
<tr>
<td>71-75</td>
<td>1</td>
<td>47</td>
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<tr>
<td>66-70</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>61-65</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>60-60</td>
<td>8</td>
<td>38</td>
</tr>
<tr>
<td>51-55</td>
<td>11</td>
<td>30</td>
</tr>
<tr>
<td>46-50</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>41-45</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>36-40</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>31-35</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>26-30</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>21-25</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Use the following formula to find the score at the $25^{th}$ percentile.

$$Y_p = Y_L + \frac{n(p) \cdot cf_b}{f_i} (i)$$

where
- $Y_p$ stands for the score at the percentile point
- $Y_L$ stands for the exact lower limit of the interval containing the score at the percentile
- $p$ stands for the percentile expressed as a proportion
- $n$ stands for the total number of scores in distribution
- $cf_b$ stands for the cumulative frequency up to lower limit of interval containing $Y_p$
- $f_i$ stands for the number of scores within the interval containing $Y_p$
- $i$ stands for the interval width (size of interval), $i = Y_u - Y_L$
Please show your work and round your final answer to one decimal place.

5.20.1. \( n(p) = \) 

5.20.2. \( Y_L = \) 

5.20.3. \( c_{f_b} = \) 

5.20.4. \( f_i = \) 

5.20.5. \( i = \) 

5.20.6. \( Y_{25} = \)

5.41. If Elwood has a score at the 37\(^{th}\) percentile, this means that _____ percent of the scores are greater than or equal to his.

5.60. The interquartile range is the distance between the score at the _____ percentile and the score at the _____ percentile.

5.74. The following distribution of scores has a mean of \( \bar{Y} = 5 \). Calculate the sum of squares \( SS_Y \) – and write the answer in the space provided.

Please show your work in the table.

<table>
<thead>
<tr>
<th>Score ((Y))</th>
<th>(Y \cdot \bar{Y})</th>
<th>((Y - \bar{Y})^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
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<td>6</td>
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<td>9</td>
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<td>3</td>
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</table>

\[ SS_Y = \]

5.80. The mean of a population \((n = 1,600)\) of scores is \( \mu_Y = 81 \). The sum of squares is \( SS_Y = 25,600 \).

5.80.1. What is the variance of this population? \( \sigma^2 = \)
5.80.2. What is the standard deviation of this population? \( \sigma = \) ________________

Show your work and round your final answer to the nearest whole number.

5.97. Many clinical assessment scales are standardized, which is to say that the scores are normally distributed with a known population mean and standard deviation. One example of such scales are the Wechsler IQ scales that have a mean, \( \mu = 100 \), and a standard deviation, \( \sigma = 15 \). By converting scores on these tests to \( z \)-scores, where

\[
Z = \frac{Y - \mu}{\sigma}.
\]

one may determine the distance from the mean to the score in units of standard deviation. This allows you to determine what proportion of the population would be expected to obtain scores below (or above) the score being evaluated.

Jake took the most recent revision of the Wechsler Intelligence Scale for Children (WISC) and received a Full Scale score of 121.

5.97.1. Jake's Full Scale WISC score is (enter the correct value to two decimal places)

________________ standard deviations

\[ \text{ABOVE THE MEAN} \quad \text{BELOW THE MEAN} \]

(circle correct answer)

Show your work and round your final answer to two decimal places.

5.97.2. What proportion of the population would be expected to score below Jake on the WISC Full Scale? Refer to Table of the Standard Normal Distribution (\( z \)) (Proportions of area under the normal curve) to obtain this proportion.

Proportion below Jake's score (to four decimal places) = ________________
6.13. For depressed individuals, intensity of stress \( X \) has been found to be related to help-seeking behavior \( Y \) = percentage seeking assistance within one week).

A prediction equation has been derived with a slope of \( B_1 = -0.2 \) and \( Y \)-intercept of \( B_0 = +4.5 \). On the following graph, draw the prediction line for help seeking percentage over the range of stress intensity from 0 to 10.

Show your calculations.

7.13. A reliability coefficient is a measure of strength of association between ________ scores and ________.

a. observed expected  
b. observed, true  
c. reliable, unreliable  
d. valid, invalid  
e. within groups, between groups
8.12. We evaluated a random sample of Michigan public school seventh graders with an empathy examination. The mean score was \( \bar{Y} = 42 \) and the standard deviation was \( s = 21 \). For a sample size of \( n = 49 \), what would be the value of the standard error of the mean (\( s_\bar{Y} \))?

\[ s_\bar{Y} = \text{___________________} \]

Show your work and round your final answer to one decimal place.

8.32. We administered the Generalized Contentment Scale (GCS) to a random sample of \( n = 36 \) clients seen at the Community Service Clinic last year. The statistics on the GCS scores for this group were

\[ \bar{Y} = 30 \quad s = 18 \quad s_\bar{Y} = 3 \]

Calculate a 95% confidence interval around the sample mean to estimate the upper and lower limits for the mean GCS score for all clients seen at the clinic last year. Refer to the Table of Critical Values for the Student \( t \) to obtain the \( t \) statistic.

Show your work and round your final answer to three decimal places.

\[ \hat{\mu}_{\text{Upper}} = \bar{Y} + (t_{0.05, df}) \cdot (s_\bar{Y}) \quad \hat{\mu}_{\text{Lower}} = \bar{Y} - (t_{0.05, df}) \cdot (s_\bar{Y}) \]

Upper Limit (\( \hat{\mu}_{\text{Upper}} \)) = _________________________

Lower Limit (\( \hat{\mu}_{\text{Lower}} \)) = _________________________

8.02. The probability of rejecting the Null Hypothesis when the Alternative Hypothesis is true is so important that it has a name. The name is ________________________.

12.10. The following represent level of functioning statistics for two groups of subjects receiving different interventions.

\[ \bar{Y}_1 = 39 \quad \bar{Y}_2 = 54 \quad n_1 = 30 \quad n_2 = 32 \]

\[ s_{1,2} = 39.36 \]

\[ s_{\bar{Y}_1 - \bar{Y}_2} = s_{1,2} \sqrt{ \frac{1}{n_1} + \frac{1}{n_2} } \quad t_{\text{obt}} = \frac{\bar{Y}_1 - \bar{Y}_2}{s_{\bar{Y}_1 - \bar{Y}_2}} \]

Fill in the following answers. Show your work and round your final answers to four decimal places. However, do not use rounded answers in calculations,

12.10.1. Calculate \( s_{\bar{Y}_1 - \bar{Y}_2} \).

\[ s_{\bar{Y}_1 - \bar{Y}_2} = \text{___________________} \]
12.10.2. Calculate $t_{obt}$.  
$t_{obt} = \quad$ 

12.10.3. What are the degrees of freedom?  
$df = \quad$ 

12.10.4. Look up $t_{crit}$ for nondirectional $\alpha = .05$.  
$t_{crit} = t_{(\alpha/2; df)} = \quad$ 

12.10.5. Is the difference between the group means statistically significant at non-directional $\alpha = .05$? 
(circle your answer).

YES   NO

14.12  We were evaluating the relative effectiveness of two training packages (anxiety reduction classes or anxiety reduction videotape) designed to help students deal with math anxiety. Each of the two training packages consisted of five weekly modules.

We randomly selected the subjects in our study from students who presented at a university clinic for participation in a treatment study on how to cope with math anxiety.

We randomly assigned each subject to receive one of two training packages: an anxiety reduction class treatment package or a videotaped treatment package. The content presented in the classes and the videotapes was identical.

Each subject receiving the first package (anxiety reduction classes) attended a class that met every Thursday from 5 PM to 7 PM for six weeks. Prior to the first session, each subject attending classes met with a social worker for thirty minutes where the subject was oriented to the program.

The first through fifth class sessions covered the material presented in one of the five modules of the package. After completing the class covering the fifth module, each subject receiving the second package met individually with his or her social worker for thirty minutes to review progress, and discuss how to maintain gains.

Each subject receiving the second package (anxiety reduction videotapes) met with a social worker at the first session for thirty minutes where the subject was oriented to the program. At this meeting, the social worker gave the subject a videotape covering the material in the first module and instructions for completion of the videotaped module at home.

At the second through fifth weekly sessions, each subject receiving the second package met with his or her social worker for ten minutes to review progress, pick up the next training module videotape, and instructions for the use of the videotape.

At the sixth session, each subject receiving the second package met with his or her social worker for thirty minutes to review progress, and discuss how to maintain gains.

After completing the program (classes or videotape), each subject filled out the Mathematics Anxiety Rating Scale – Revised (MARS–R). The MARS–R is a 24-item instrument. Respondents rate each item using a five point scale from 1 = low anxiety to 5 = high anxiety. The MARS–R score is the sum of item ratings with higher scores indicating more intense anxiety (Plake & Parker, 1982).

The distribution of MARS–R scores is positively skewed.

We compared the subjects’ MARS-R scores between the two training packages.
14.12.1. The independent variable in this study refers to which one of the following.
   a. (1) anxiety about mathematics, (2) other anxiety
   b. (1) anxiety reduction class, (2) anxiety reduction videotape.
   c. five modules.
   d. length of time in training.
   e. MARS–R score.
   f. math anxiety.
   g. pre-participation vs. post-participation status
   h. (1) social worker, (2) student
   i. (1) students with math anxiety, (2) students without math anxiety.
   j. six weeks.
   k. training package.
   l. presenting problem
   m. (1) social worker, (2) student
   n. (1) students with math anxiety, (2) students without math anxiety.
   o. six weeks.
   p. training package.

14.12.2. Levels of the independent variable in this study refer to which of the following.
   a. (1) anxiety about mathematics, (2) other anxiety
   b. (1) anxiety reduction class, (2) anxiety reduction videotape.
   c. five modules.
   d. length of time in training.
   e. MARS–R score.
   f. math anxiety.
   g. pre-participation vs. post-participation status
   h. (1) social worker, (2) student
   i. (1) students with math anxiety, (2) students without math anxiety.
   j. six weeks.
   k. training package.
   l. presenting problem
   m. (1) social worker, (2) student
   n. (1) students with math anxiety, (2) students without math anxiety.
   o. six weeks.
   p. training package.

14.12.3. The dependent variable in this study refers to which of the following.
   a. (1) anxiety about mathematics, (2) other anxiety
   b. (1) anxiety reduction class, (2) anxiety reduction videotape.
   c. five modules.
   d. length of time in training.
   e. MARS–R score.
   f. math anxiety.
   g. pre-participation vs. post-participation status
   h. (1) social worker, (2) student
   i. (1) students with math anxiety, (2) students without math anxiety.
   j. six weeks.
   k. training package.

14.12.4. The dependent measure in this study refers to which of the following.
   a. (1) anxiety about mathematics, (2) other anxiety
   b. (1) anxiety reduction class, (2) anxiety reduction videotape.
   c. five modules.
   d. length of time in training.
   e. MARS–R score.
   f. math anxiety.
   g. pre-participation vs. post-participation status
   h. (1) social worker, (2) student
   i. (1) students with math anxiety, (2) students without math anxiety.
   j. six weeks.
   k. training package.

14.12.5. Identify the level of measurement for the dependent measure.
   a. Nominal
   b. Ordinal
   c. Interval
   d. Ratio
14.12.6. What type of research design was used?

a. Single sample comparison
[Uses a single sample. Evaluates difference between sample dependent measure values and known or theoretical population dependent measure values.]

b. \( j = 2 \) dependent samples comparison: pre-post
[Uses a single sample. Evaluates change between pre-test and post-test dependent measure values for sampling units.]

c. \( j = 2 \) dependent samples comparison: matched pairs
[Uses two samples of matched sampling units (pairs). Evaluates difference between dependent measure values for matched pairs of sampling units.]

d. \( j > 2 \) independent samples comparison:
[Uses samples formed by assigning sampling units to two different levels of the independent variable or uses samples selected from two different populations. Evaluates difference between dependent measure values for the two samples.]

e. \( j > 2 \) independent samples comparison:
[Uses samples formed by assigning sampling units to each of the \( j > 2 \) levels of the independent variable or uses samples selected from each of the \( j > 2 \) populations. Evaluates differences among dependent measure values for all samples.]

14.12.7. Please evaluate this research vignette using the assumptions for statistical hypothesis tests to determine which, if any, statistical hypothesis test would be appropriate to evaluate the data from this research.

Begin by briefly discussing whether the design and data meet the two basic (and most important) assumptions for all statistical hypothesis tests. Fully discuss how the design meets or does not meet the criteria for each of these assumptions. Unequivocally state whether or not each of these assumptions are met. Based upon this brief discussion, unequivocally state whether or not any statistical hypothesis test would be appropriate.

If you decide that some test would be appropriate, evaluate how this study meets or does not meet the additional assumptions for a specific statistical test. Otherwise, go to the next question.

Identify the tests appropriate for the research design used in this study. Then identify which of these tests would be ruled out due to the scaling of the dependent measure. If appropriate, identify which of the remaining tests would be ruled out due to the type of distribution of the dependent measure scores.

Your discussion of the assumptions must support your conclusion about which, if any, test is appropriate. Your entire explanation should contain fewer than 200 words.
14.12.8. Which (if any) of the following statistical hypothesis tests should we use to determine if there is a statistically significant effect?

a. 2 x k chi-square test of independence  
b. dependent samples Student t test  
c. goodness-of-fit chi-square test  
d. independent samples Student t test  
e. j x k chi-square test of independence  
f. Kruskal-Wallis test  
g. McNemar change test  
h. one-way analysis of variance  
i. single sample Kolmogorov-Smirnov test  
j. single sample Student t test  
k. Wilcoxon/Mann-Whitney test  
l. Wilcoxon T (matched pair, signed ranks) test  
m. none of these tests would be appropriate

14.45 We wish to discover whether clients with problems with anger were helped with expressive/catharsis treatment (A). We defined anger as using aggression as tactic to resolve interpersonal conflicts.

We randomly selected twenty clients from over 500 clients seen over an eighteen-month period who desired help in managing their anger. An evaluation team assessed the frequency that each client used each of three conflict resolution tactics: aggression, negotiation, and submission. This assessment was a routine component of intake. An anger problem was defined as using aggression to resolve interpersonal conflicts (anger-provoking incidents). Clients who used aggression to resolve interpersonal conflicts were eligible for treatment for anger problems.

Clients participated in 12 weekly individual therapy sessions.

At the conclusion of treatment, an evaluation team re-assessed each clients frequency of use of the three conflict resolution tactics.

We evaluated the changes in the rates of use of aggression between the pre-intervention assessment and the post-intervention assessment. Changes in rates showed a positively skewed and markedly bimodal distribution.

14.45.1. The independent variable in this study refers to which of the following.

a. (1) adaptive response to anger provoking incident,  
   (2) non-adaptive response to anger provoking incident.  
b. (1) aggression, (2) negotiation,  
   (3) submission.  
c. anger.  
d. (1) anger management problem,  
   (2) other problem.  
e. (1) before intervention, (2) after intervention.

f. (1) expressive/catharsis treatment,  
   (2) negotiation/empathy development treatment.  
g. intervention status.  
h. presenting problem.  
i. change in frequency of use of aggression.  
j. (1) 12 weeks, (2) 3 months.  
k. therapist rating of anger level.

14.45.2. Levels of the independent variable in this study refer to which of the following.

a. (1) adaptive response to anger provoking incident,  
   (2) non-adaptive response to anger provoking incident.  
b. (1) aggression, (2) negotiation,  
   (3) submission.  
c. anger.  
d. (1) anger management problem,  
   (2) other problem.  
e. (1) before intervention, (2) after intervention.

f. (1) expressive/catharsis treatment,  
   (2) negotiation/empathy development treatment.  
g. intervention status.  
h. presenting problem.  
i. change in frequency of use of aggression.  
j. (1) 12 weeks, (2) 3 months.  
k. therapist rating of anger level.

14.45.3. The dependent variable in this study refers to which of the following.

a. (1) adaptive response to anger provoking incident,  
   (2) non-adaptive response to anger provoking incident.  
b. (1) aggression, (2) negotiation,  
   (3) submission.  
c. anger.  
d. (1) anger management problem,  
   (2) other problem.  
e. (1) before intervention, (2) after intervention.

f. (1) expressive/catharsis treatment,  
   (2) negotiation/empathy development treatment.  
g. intervention status.  
h. presenting problem.  
i. change in frequency of use of aggression.  
j. (1) 12 weeks, (2) 3 months.  
k. therapist rating of anger level.
14.45.4. The dependent measure in this study refers to which of the following.
   a. (1) adaptive response to anger provoking incident, (2) non-adaptive response to anger provoking incident.
   b. (1) aggression, (2) negotiation, (3) submission.
   c. anger.
   d. (1) anger management problem, (2) other problem.
   e. (1) before intervention, (2) after intervention.
   f. (1) expressive/catharsis treatment, (2) negotiation/empathy development treatment.

14.45.5. Identify the level of measurement for the dependent measure.
   a. nominal  c. interval
   b. ordinal  d. ratio

14.45.6. What type of research design was used?
   a. Single sample comparison  
      [Uses a single sample. Evaluates difference between sample dependent measure values and known or theoretical population dependent measure values.]
   b. j = 2 dependent samples comparison: pre-post  
      [Uses a single sample. Evaluates change between pre-test and post-test dependent measure values for sampling units.]
   c. j = 2 dependent samples comparison: matched pairs  
      [Uses two samples of matched sampling units (pairs). Evaluates difference between dependent measure values for matched pairs of sampling units.]
   d. j = 2 independent samples comparison:  
      [Uses samples formed by assigning sampling units to two different levels of the independent variable or uses samples selected from two different populations. Evaluates difference between dependent measure values for the two samples.]
   e. j > 2 independent samples comparison:  
      [Uses samples formed by assigning sampling units to each of the j>2 levels of the independent variable or uses samples selected from each of the j>2 populations. Evaluates differences among dependent measure values for all samples.]

14.45.8. Which (if any) of the following statistical hypothesis tests should we use to determine if there is a statistically significant effect?
   a. 2 x k chi-square test of independence  
      b. dependent samples Student t test  
      c. goodness-of-fit chi-square test  
      d. independent samples Student t test  
      e. j x k chi-square test of independence  
      f. Kruskal-Wallis test  
      g. McNemar change test  
      h. one-way analysis of variance  
      i. single sample Kolmogorov-Smirnov test  
      j. single sample Student t test  
      k. Wilcoxon/Mann-Whitney test  
      l. Wilcoxon T (matched pair, signed ranks) test  
      m. none of these tests would be appropriate
14.45.7. **Please evaluate this research vignette using the assumptions for statistical hypothesis tests to determine which, if any, statistical hypothesis test would be appropriate to evaluate the data from this research.**

Begin by briefly discussing whether the design and data meet the two basic (and most important) assumptions for all statistical hypothesis tests. Fully discuss how the design meets or does not meet the criteria for each of these assumptions. Unequivocally state whether or not each of these assumptions are met. Based upon this brief discussion, unequivocally state whether or not any statistical hypothesis test would be appropriate.

*If you decide that some test would be appropriate,* evaluate how this study meets or does not meet the additional assumptions for a specific statistical test. Otherwise, go to the next question.

Identify the tests appropriate for the research design used in this study. Then identify which of these tests would be ruled out due to the scaling of the dependent measure. If appropriate, identify which of the remaining tests would be ruled out due to the type of distribution of the dependent measure scores.

Your discussion of the assumptions must support your conclusion about which, if any, test is appropriate. Your entire explanation should contain fewer than 200 words.

14.45.8. Which (if any) of the following statistical hypothesis tests should we use to determine if there is a statistically significant effect?

- a. 2 x k chi-square test of independence
- b. dependent samples Student $t$ test
- c. goodness-of-fit chi-square test
- d. independent samples Student $t$ test
- e. j x k chi-square test of independence
- f. Kruskal-Wallis test
- g. McNemar change test
- h. one-way analysis of variance
- i. single sample Kolmogorov-Smirnov test
- j. single sample Student $t$ test
- k. Wilcoxon/Mann-Whitney test
- l. Wilcoxon $T$ (matched pair, signed ranks) test
- m. none of these tests would be appropriate

14.51. We randomly selected $n = 36$ students from sixth and seventh grade students referred for truancy from the 18 middle schools in the Thatcher independent school district. The selection procedure included the requirement that each middle school be represented in the sample, and that each grade level be represented within a middle school.

Table 1.01 shows the numbers of unexcused absences for the 36 students in the sample for the six weeks before referral. Table 1.02 shows the statewide records for sixth graders on unexcused absences over the six weeks prior to referral for truancy.

We wish to know whether sixth and seventh graders referred for truancy in the Thatcher independent school district differ in number of unexcused absent days from the statewide population of sixth and seventh graders referred for truancy.
Table 1.01: Thatcher District (6th and 7th Grades)

<table>
<thead>
<tr>
<th>Unexcused Absent Days</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 – 36</td>
<td>2</td>
</tr>
<tr>
<td>17 – 24</td>
<td>9</td>
</tr>
<tr>
<td>13 – 16</td>
<td>11</td>
</tr>
<tr>
<td>9 – 12</td>
<td>7</td>
</tr>
<tr>
<td>7 – 8</td>
<td>4</td>
</tr>
<tr>
<td>5 – 6</td>
<td>3</td>
</tr>
<tr>
<td>0 – 4</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1.02: Statewide (6th and 7th Grades)

<table>
<thead>
<tr>
<th>Unexcused Absent Days</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 – 36</td>
<td>3%</td>
</tr>
<tr>
<td>17 – 24</td>
<td>22%</td>
</tr>
<tr>
<td>13 – 16</td>
<td>23%</td>
</tr>
<tr>
<td>9 – 12</td>
<td>22%</td>
</tr>
<tr>
<td>7 – 8</td>
<td>13%</td>
</tr>
<tr>
<td>5 – 6</td>
<td>6%</td>
</tr>
<tr>
<td>0 – 4</td>
<td>1%</td>
</tr>
</tbody>
</table>

14.51.1. The independent variable in this study refers to which one of the following.

a. grade level.
b. groups (populations) compared.
c. referral status.
d. (1) referred, (2) not referred.
e. (1) sixth graders (2) seventh graders.

f. (1) Thatcher district, (2) statewide.
g. truancy.
h. unexcused absent days.
i. 25 middle schools.

14.51.2. Levels of the independent variable in this study refer to which one of the following.

a. grade level.
b. groups (populations) compared.
c. referral status.
d. (1) referred, (2) not referred.
e. (1) sixth graders (2) seventh graders.

f. (1) Thatcher district, (2) statewide.
g. truancy.
h. unexcused absent days.
i. 25 middle schools.

14.51.3. The dependent variable in this study refers to which one of the following.

a. grade level.
b. groups (populations) compared.
c. referral status.
d. (1) referred, (2) not referred.
e. (1) sixth graders (2) seventh graders.

f. (1) Thatcher district, (2) statewide.
g. truancy.
h. unexcused absent days.
i. 25 middle schools.

14.51.4. The dependent measure in this study refers to which one of the following.

a. grade level.
b. groups (populations) compared.
c. referral status.
d. (1) referred, (2) not referred.
e. (1) sixth graders (2) seventh graders.

f. (1) Thatcher district, (2) statewide.
g. truancy.
h. unexcused absent days.
i. 25 middle schools.

14.51.5. Identify the level of measurement for the dependent measure.

a. nominal
b. ordinal
c. interval
d. ratio
14.51.6. What type of research design was used?
   a. single sample comparison
      [Uses a single sample. Evaluates difference between sample dependent measure values and known or theoretical population dependent measure values.]
   b. \(j = 2\) dependent samples comparison: pre-post
      [Uses a single sample. Evaluates change between pre-test and post-test dependent measure values for sampling units.]
   c. \(j = 2\) dependent samples comparison: matched pairs
      [Uses two samples of matched sampling units (pairs). Evaluates difference between dependent measure values for matched pairs of sampling units.]
   d. \(j = 2\) independent samples comparison:
      [Uses samples formed by assigning sampling units to two different levels of the independent variable or uses samples selected from two different populations. Evaluates difference between dependent measure values for the two samples.]
   e. \(j > 2\) independent samples comparison:
      [Uses samples formed by assigning sampling units to each of the \(j > 2\) levels of the independent variable or uses samples selected from each of the \(j > 2\) populations. Evaluates differences among dependent measure values for all samples.]

14.51.7. Please evaluate this research vignette using the assumptions for statistical hypothesis tests to determine which, if any, statistical hypothesis test would be appropriate to evaluate the data from this research.
Begin by briefly discussing whether the design and data meet the two basic (and most important) assumptions for all statistical hypothesis tests. Fully discuss how the design meets or does not meet the criteria for each of these assumptions. Unequivocally state whether or not each of these assumptions are met. Based upon this brief discussion, unequivocally state whether or not any statistical hypothesis test would be appropriate.
If you decide that some test would be appropriate, evaluate how this study meets or does not meet the additional assumptions for a specific statistical test. Otherwise, go to the next question.
Identify the tests appropriate for the research design used in this study. Then identify which of these tests would be ruled out due to the scaling of the dependent measure. If appropriate, identify which of the remaining tests would be ruled out due to the type of distribution of the dependent measure scores.
Your discussion of the assumptions must support your conclusion about which, if any, test is appropriate. Your entire explanation should contain fewer than 200 words.
14.51.8. Which (if any) of the following statistical hypothesis tests should we use to determine if there is a statistically significant effect?

a. 2 x k chi-square test of independence
b. dependent samples Student t test
c. goodness-of-fit chi-square test
d. independent samples Student t test
e. j x k chi-square test of independence
f. Kruskal-Wallis test
g. McNemar change test
h. one-way analysis of variance
i. single sample Kolmogorov-Smirnov test
j. single sample Student t test
k. Wilcoxon/Mann-Whitney test
l. Wilcoxon T (matched pair, signed ranks) test
m. none of these tests would be appropriate

15.50 You are conducting a study on the relative effectiveness of two techniques designed to help clients deal with depression. One technique is currently in use and the new technique would require extensive (and expensive) training of staff if it were to be provided throughout the state. Because of this, you would not be interested in detecting a small difference. You would want to have a medium effect size (as defined by Cohen) before you would implement statewide training.

The design used for the evaluation will be a j=2 independent samples design. Outcome measure scores are normally-distributed (which implies interval or ratio level scaling).

To identify the appropriate test, you must
- identify tests appropriate to the research design
- identify tests appropriate to the level at which the dependent (outcome) variable is being measured and, if relevant, to the distribution of dependent measure scores.

15.50.1. Appropriate Test = ______________________________

Using non-directional \( \alpha = .05 \) and a power level of \( 1-\beta = .80 \), how large a sample should you select?

15.50.2. Total Sample Size = ______________________________

10.05. Here is a descriptive statistics layout and ANOVA summary table for \( j = 5 \) groups with \( n_j = 8 \) subjects in each group.

<table>
<thead>
<tr>
<th>Levels of the Independent Variable (j)</th>
<th>Total Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \bar{Y}_1 = 6.00 )</td>
</tr>
<tr>
<td></td>
<td>( s_1 = 3.338 )</td>
</tr>
<tr>
<td></td>
<td>( n_1 = 8 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares (SS)</th>
<th>df</th>
<th>Mean Square (MS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups [A]</td>
<td>217.6</td>
<td>4</td>
<td>54.4000</td>
</tr>
<tr>
<td>Within Groups [S(A)]</td>
<td>780.0</td>
<td>35</td>
<td>22.2857</td>
</tr>
<tr>
<td>Total</td>
<td>997.6</td>
<td>39</td>
<td></td>
</tr>
</tbody>
</table>

\[
F_{obt} = \frac{MS_{Between}}{MS_{Within}} = \frac{MS_A}{MS_{S(A)}} \quad \eta^2 = \frac{SS_{Between}}{SS_{Total}} = \frac{SS_A}{SS_{Total}}
\]

10.05.1. Calculate \( F_{obt} \) (the obtained \( F \)) for these data. Please round your final answer to two decimal places.

\( F_{obt} = \) __________.

10.05.2. Calculate \( \eta^2 \) (eta-square) for these data. Please round your final answer to two decimal places.

\( \eta^2 = \) __________.
10.05.3. What are the numerator degrees of freedom for $F$? $\text{df}_{\text{num}} = \underline{\text{_______}}$.

10.05.4. What are the denominator degrees of freedom for $F$? $\text{df}_{\text{den}} = \underline{\text{_______}}$.

10.05.5. Find the critical $F$ ($F_{\text{crit}}$) at the appropriate degrees of freedom at $\alpha = .05$. $F_{\text{crit}} = \underline{\text{_______}}$.

10.05.6. Based upon the results of the analysis of variance, should you carry out post hoc comparisons among all pairs of dependent measure means for the $j = 4$ groups? Circle your decision.

YES \hspace{1cm} NO

10.05.7. Explain your decision about post hoc testing in 150 words or fewer. Address the issues of the ANOVA Null Hypothesis and of capitalization on chance in this explanation.

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

16.76. Here is a factorial means layout and ANOVA summary table for $j = 3$ levels of factor A (Intervention) and $k = 3$ levels of factor B (Support Services).

| Support Services [B]: $k = 3$ | \begin{array}{c|c|c|c} \text{Intervention [A]: $j=3$} & 1 & 2 & 3 \end{array} | \begin{array}{c} \text{A: Main Effects} \\ \text{B: Main Effects} \end{array} |
|--------------------------|-----------------|-----------------|-----------------|
| \text{1} & $\overline{Y}_{11} = 8.000$ & $\overline{Y}_{12} = 7.000$ & $\overline{Y}_{13} = 8.000$ & $\overline{Y}_1 = 7.667$ & $\overline{Y}_{11} = 8.000$ & $\overline{Y}_{12} = 7.000$ & $\overline{Y}_{13} = 8.000$ & $\overline{Y}_1 = 7.667$ |
| & $s_{11} = 4.000$ & $s_{12} = 2.390$ & $s_{13} = 4.000$ & $s_1 = 3.422$ & $n_{11} = 8$ & $n_{12} = 8$ & $n_{13} = 8$ & $n_1 = 24$ |
| \text{2} & $\overline{Y}_{21} = 6.000$ & $\overline{Y}_{22} = 12.000$ & $\overline{Y}_{23} = 11.500$ & $\overline{Y}_2 = 9.833$ & $\overline{Y}_{21} = 6.000$ & $\overline{Y}_{22} = 12.000$ & $\overline{Y}_{23} = 11.500$ & $\overline{Y}_2 = 9.833$ |
| & $s_{21} = 2.449$ & $s_{22} = 2.726$ & $s_{23} = 3.665$ & $s_2 = 3.985$ & $n_{21} = 8$ & $n_{22} = 8$ & $n_{23} = 8$ & $n_2 = 24$ |
| \text{3} & $\overline{Y}_{31} = 8.000$ & $\overline{Y}_{32} = 11.500$ & $\overline{Y}_{33} = 11.000$ & $\overline{Y}_3 = 10.167$ & $\overline{Y}_{31} = 8.000$ & $\overline{Y}_{32} = 11.500$ & $\overline{Y}_{33} = 11.000$ & $\overline{Y}_3 = 10.167$ |
| & $s_{31} = 1.690$ & $s_{32} = 3.665$ & $s_{33} = 2.726$ & $s_3 = 3.261$ & $n_{31} = 8$ & $n_{32} = 8$ & $n_{33} = 8$ & $n_3 = 24$ |
| \text{B: Main Effects} & $\overline{Y}_{.1} = 7.333$ & $\overline{Y}_{.2} = 10.167$ & $\overline{Y}_{.3} = 10.167$ & $\overline{Y}_.$ = 9.222 & $\overline{Y}_{.1} = 7.333$ & $\overline{Y}_{.2} = 10.167$ & $\overline{Y}_{.3} = 10.167$ & $\overline{Y}_.$ = 9.222 |
| & $s_{.1} = 2.914$ & $s_{.2} = 3.655$ & $s_{.3} = 3.703$ & $s_.$ = 3.651 & $n_{.1} = 24$ & $n_{.2} = 24$ & $n_{.3} = 24$ & $n_.$ = 72 |

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares (SS)</th>
<th>df</th>
<th>Mean Square (MS)</th>
<th>$F_{\text{obt}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model [AB]</td>
<td>328.4444</td>
<td>8</td>
<td>41.0556</td>
<td>4.19</td>
</tr>
<tr>
<td>Intervention [A]</td>
<td>88.4444</td>
<td>2</td>
<td>44.2222</td>
<td>4.51</td>
</tr>
<tr>
<td>Support Services [B]</td>
<td>128.4444</td>
<td>2</td>
<td>64.2222</td>
<td>6.55</td>
</tr>
<tr>
<td>Interaction [AxB]</td>
<td>111.5556</td>
<td>4</td>
<td>27.8889</td>
<td>2.84</td>
</tr>
<tr>
<td>Within Groups [S(AB)]</td>
<td>618.0000</td>
<td>63</td>
<td>9.8095</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>946.4444</td>
<td>71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Report the numerator and denominator degrees of freedom for each of the critical values for $F$ for each of the effects, as well as the appropriate ($\alpha = .05$) critical values for $F$.

16.76.1. Overall Model [AB]: $df_{numerator} = ____$  $df_{denominator} = ____$  $F_{crit} = ________$

16.76.2. Main Effects [A]: $df_{numerator} = ____$  $df_{denominator} = ____$  $F_{crit} = ________$

16.76.3. Main Effects [B]: $df_{numerator} = ____$  $df_{denominator} = ____$  $F_{crit} = ________$

16.76.4. Interaction [AB]: $df_{numerator} = ____$  $df_{denominator} = ____$  $F_{crit} = ________$

16.76.5. The interpretation of findings of statistical significance and statistical non-significance differs for each $F_{obt}$. We evaluate the obtained $F$'s in a specified order. The outcome of the evaluation of an obtained $F$ that is earlier in the sequence determines whether we evaluate a subsequent $F_{obt}$.

Evaluate the appropriate obtained $F$'s in this analysis. Report your decision about statistical significance for the obtained $F$ and specify the next step in the sequence. Only evaluate those obtained $F$'s that you should evaluate.

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

16.76.6. Which, if any, post hoc multiple pairwise comparisons would you carry out? Circle your decision:

a. no comparisons,
b. comparisons among all combined effect (crossed factor) groups [AB],
c. main effect of intervention [A],
d. main effects of support [B], or
e. both main effects [A] and [B].

End of Exam

Have a pleasant Break!