Multiple Choice (1-point each)

1. For an experiment comparing more than two treatment conditions you should use analysis of variance rather than separate t tests because _____.
   a. separate t tests would require substantially more computations.
   b. a test based on variances is more sensitive than a test based on means.
   c. conducting several t tests would inflate the risk of a Type I error.
   d. There is no difference between the two tests, you can use either one.

2. A researcher uses an analysis of variance to test for mean differences among three treatment conditions using a sample of \( n = 8 \) participants in each treatment. What degrees of freedom (\( df \)) would the F-ratio from this analysis have?
   a. \( df = 23 \)
   b. \( df = 2, 23 \)
   c. \( df = 3, 21 \)
   d. \( df = 2, 21 \)

3. In general, what factors will produce the largest F-ratio?
   a. small mean differences and small variances
   b. small mean differences and large variances
   c. large mean differences and small variances
   d. large mean differences and large variances

4. The following table shows the results of an analysis of variance comparing three treatment conditions with a sample of \( n = 10 \) participants in each treatment. Note that several values are missing in the table. What is the missing value for \( SS_{\text{total}} \)?

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>( F = xx )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>20</td>
<td>xx</td>
<td>xx</td>
<td>F = xx</td>
</tr>
<tr>
<td>Within</td>
<td>xx</td>
<td>xx</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>xx</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   a. 22
   b. 30
   c. 54
   d. 74

5. In an analysis of variance, which of the following is not true?
   a. \( SS_{\text{total}} = SS_{\text{between}} + SS_{\text{within}} \)
   b. \( df_{\text{total}} = df_{\text{between}} + df_{\text{within}} \)
   c. \( MS_{\text{total}} = MS_{\text{between}} + MS_{\text{within}} \)
   d. All three choices (a, b, and c) are true.

6. An analysis of variance is used to evaluate the mean differences for a research study comparing four treatments with a separate sample of \( n = 5 \) in each treatment. If the data produce an F-ratio of \( F = 3.15 \), then which of the following is the correct statistical decision?
   a. Reject the null hypothesis with \( \alpha = .05 \) but not with \( \alpha = .01 \).
   b. Reject the null hypothesis with either \( \alpha = .05 \) or \( \alpha = .01 \).
   c. Fail to reject the null hypothesis with either \( \alpha = .05 \) or \( \alpha = .01 \).
   d. There is not enough information to make a statistical decision.
7. Describe the circumstances under which you should use ANOVA instead of t tests, and explain why t tests are inappropriate in these circumstances. (3-points)

8. What value is expected, on average, for the F-ratio in ANOVA when the null hypothesis is true? Explain why this value is expected. (2-points)

9. Alice Isen looks for factors that affect thinking. In one study, she had three groups of participants work on seven remote associates problems, which require creative thinking. One group prepared for the task by exercising; a second group watched a comedy video; the third group was a control group that simply began work on the problems. The scores below show the number correct for each participant. Is there a significant difference among the mean scores for the groups. Perform an ANOVA, complete the summary table, and answer each of the questions below.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Comedy</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

ANOVA Summary Table
(Fill in all appropriate boxes – 1-point each)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
</table>

a. What is the research/alternative hypothesis (in words) (1-point)?

b. What is the F-critical value (1-point)?

c. Do you reject or fail to reject the null hypothesis? (1-point)

d. What is the Tukey HSD value? (2-points)

e. Based on your findings what would you conclude (relate back to the original purpose of the research and BE SPECIFIC) (3-points)?
