Instructions: This exam contains 33 Multiple Choice questions. Each question is worth 3 points, for a total of 99 points. The last point will be awarded for correctly bubbling in your name, UFID number and Test Form Code on the scantron sheet. Select the best answer among the alternatives given.

You may write whatever you want on this test, but only the answers bubbled in the scantron sheet will be graded. This test MUST BE SUBMITTED to the instructors together with the scantron sheet for you to receive a grade on the exam.

Honor pledge: "On my honor, I have neither given nor received unauthorized aid on this examination."

Signature: ____________________________

Questions 1–15 House prices can vary considerably depending on the location of the house, square footage, number of bathrooms, bedrooms, condition and size of the lot. The following is a partial computer output for comparing the price of 2 bedroom, 3 bedroom, and 4 bedroom houses sold in Gainesville in recent months. Prices were recorded in thousands of dollars, so a house that sold for $135,600 appears as 135.6.

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
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<tr>
<td>Bedrooms</td>
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<tr>
<td>Error</td>
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<td>2984</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
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<td>177990</td>
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</tbody>
</table>

Individual 95% CIs For Mean Based on Pooled StDev

Level  N  Mean  StDev
2bd  16  98.50 39.72
3bd  16  112.24 54.94
4bd  16  169.69 65.99

1. We need to assume here that we have:
   a) a randomly selected city.
   b) a random assignment of bedrooms to houses.
   c) randomly selected bedroom numbers.
   d) all of the above.

2. How many replications are used in this study?
   a) 45  b) 48  c) 23  d) 16  e) 24

3. The response variable in this study is:
   a) bedrooms  b) cities  c) houses  d) prices  e) square footage

4. How many factors are used in this study?
   a) 1  b) 2  c) 3  d) 48  e) 45

5. To find the p-value on the F table we need to use:
   a) df=45  b) df=15  c) df=2 df=47  d) df=2 df=45  e) df=2 df=45 df=47

6. Which of these is a correct interpretation of the null hypothesis here, in words?
   a) The number of houses in each group are all the same, on average.
   b) The number of houses in each group are not all the same, on average.
   c) House prices are different, on average, depending on number of bedrooms.
   d) House prices, on average, do not depend on number of bedrooms.

7. At a significance level of 0.05 we can conclude from the ANOVA test that the population means of the three groups are
   a) all equal.  b) all different.  c) not all equal.  d) equal to their variances
8. Which of the following is the best interpretation of the confidence intervals from the output?  
   a) Average house prices increase significantly with number of bedrooms.  
   b) Standard deviation of house prices increase significantly with number of bedrooms.  
   c) Four-bedroom houses are significantly more expensive than two and three bedroom houses.  
   d) Two-bedroom houses are significantly less expensive than three and four bedroom houses.  
   e) all of the above.

9. When making all pairwise comparisons for this problem, using the Bonferroni procedure with 97% FAMILY confidence, what confidence level should we use for each interval?  
   a) 88%  
   b) 91%  
   c) 97%  
   d) 99%  
   e) 100%

10. When making all pairwise comparisons for this problem, using the Bonferroni procedure with confidence level of 97% for EACH interval, what would be the family confidence level?  
   a) 88%  
   b) 91%  
   c) 97%  
   d) 99%  
   e) 100%

11. When making all pairwise comparisons with 97% family confidence, the margin of error was determined to be 49.73. Which of the following is the best summary of the results?  
   a) 2bd 98.50  
   b) 2bd 98.50  
   c) 2bd 98.50  
   d) 2bd 98.50  
   e) 2bd 98.50

12. When making all pairwise comparisons for this problem using the Bonferroni procedure, how many degrees of freedom should we use for each interval?  
   a) 30  
   b) 45  
   c) 47  
   d) 15  
   e) 16

13. The pooled standard deviation is:  
   a) 54.63  
   b) 53.55  
   c) 58.52  
   d) 151.1  
   e) 149.2

14. If our study included also the number of bathrooms in each house (1,2,3,4), then we would be adding to the study:  
   a) one more factor, with four levels.  
   b) four more factors, with one level each.  
   c) one more level for each of four existing factors.  
   d) four more levels for an existing factor.  
   e) none of the above—the numbers of factors and levels would not change.

15. If our original study (ignoring the previous question) had included four additional houses of each size according to number of bedrooms, then we would be adding to the study:  
   a) one more factor, with four levels.  
   b) four more factors, with one level each.  
   c) one more level for each of four existing factors.  
   d) four more levels for an existing factor.  
   e) none of the above—the numbers of factors and levels would not change.

16. Suppose the ANOVA F test statistic is 3.06. The table reports that, for the appropriate df, the F value with Right-Tail Probability=0.05 is 2.99. Then we can say that:  
   a) The p-value is less than 0.05.  
   b) The p-value is greater than 0.05.  
   c) The p-value is less than 2.99.  
   d) The p-value is less than 3.06.  
   e) The p-value is equal to 0.07.

17. Find the value of the test statistic:  
   a) 22.92  
   b) 19.44  
   c) 8.14  
   d) 1.36  
   e) 52.75

<table>
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<tbody>
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<tr>
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<tr>
<td>Total</td>
<td>35</td>
<td>458.14</td>
<td></td>
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</tbody>
</table>
18. We use statistical inference when we don't know:
   (a) the parameters  (b) the point estimators
   (c) the test statistic  (d) the critical values

19. An experiment compares five groups and has 6 observations per group. Find the degrees of freedom for error.
   a) 11       b) 30       c) 25       d) 4       e) 1

20. For subjects aged under 50, there is little difference in mean annual medical expenses for smokers and non-smokers. For subjects aged over 50, there is a large difference. We can conclude that:
   a) there is no significant effect in annual medical expenses between smokers and non-smokers.
   b) there is a significant effect in annual medical expenses between smokers and non-smokers.
   c) there is no significant effect in annual medical expenses between people under 50 and those over 50.
   d) there is a significant effect in annual medical expenses between people under 50 and those over 50.
   e) there is interaction between smoking status and age in their effects on annual medical expenses.

21. Provided everything else stays the same, less variability within the groups would correspond to:
   a) more evidence of differences between the groups. ✓
   b) less evidence of differences between the groups.
   c) more variability between the groups.
   d) less variability between the groups.

22. In One-Way ANOVA, we estimate the variance within the groups and between the groups with
   a) SSE and SSG  b) MSG and MSE  c) SSG and SSE  d) MSE and MSG
   e) the value of $F$ and the p-value

Questions 23 – 25: Humpback whales are famous for their complex “songs,” which vary in length and are repeated continuously for many hours. The songs of whales may vary in length by geographical area and also at different times of the year. The following plot represents the average song length, in minutes, of humpback whale songs in three oceans (Atlantic, Pacific, and Indian) and two seasons (winter and summer).

23. The two factors in this study are
   a) ocean and season.
   b) ocean and song length.
   c) season and song length.
   d) winter and summer.
   e) ocean and summer.

24. Which of the following interpretations of this graph is most clearly correct?
   a) In general, whales in the Atlantic have longer songs during both seasons.
   b) In general, whales in the Pacific have longer songs during both seasons.
   c) In general, whales have longer songs in winter for all three oceans.
   d) In general, whales have longer songs in summer for all three oceans.
   e) Whether whales have longer songs in winter or summer depends on which ocean is being considered.

25. Based on this graph, in how many of the three two-way ANOVA $F$ tests (each main effect, plus interaction) we would expect to have small p-values?
   a) 0  b) 1  c) 2  d) 3

   Int = big  p-val = small
   Ocean = big
26. In hypothesis testing, which of the following statements is always true?
   a) The p-value is greater than the significance level alpha. ×
   b) The p-value is computed from the significance level alpha. ×
   c) The p-value is the parameter in the null hypothesis. ×
   d) The p-value is a test statistic. ×
   e) The p-value is a probability.

27. In One-Way ANOVA, the test statistic \( F = 0 \) indicates:
   a) an error in the computations. ×
   b) that all group means are exactly the same. ×
   c) that there was no way to measure the variability within the groups. ×
   d) that the MSG was equal to the MSE. ×

28. In One-Way ANOVA, the test statistic \( F = \infty \) indicates:
   a) an error in the computations. ×
   b) that all group means are exactly the same. ×
   c) that there was no way to measure the variability within the groups. ×
   d) that the MSG was equal to the MSE. ×

Questions 29 - 33

It is not surprising that seemingly irrelevant characteristics such as physical attractiveness can subconsciously influence employers' decisions in the hiring process. However, some people believe that such traits may actually help employers predict future job performance in a quantifiable way. Each of the five situations below describes an inference that we would like to make about a different parameter. Match each of the five situations below with the parameter of interest from the list.

- a) one mean
- b) one proportion
- c) difference of two independent means
- d) difference of two independent proportions
- e) mean of matched paired differences

29. The people rated as "attractive" may be less efficient than the people rated as "average" or "unattractive", but perhaps only slightly: The "attractive" group completed only 22.4 tasks per week on average, compared to 25.3 for the other group.

30. People rated as "attractive" and "unattractive" were partnered off and asked to each complete the same task while competing against each other to finish first. The people rated as "attractive" finished in 93.9 minutes on average, while the people rated as "unattractive" took 95.1 minutes.

31. This belief is widespread but not the majority opinion: Only 37.5% of managers said that they believed physical attractiveness and job performance could be connected in a scientific way.

32. The ability to learn new skills lacks any strong relationship to attractiveness: 66.2% of people rated as "attractive" passed a competency evaluation at the end of training, compared to 63.4% of people rated as "average" or "unattractive."

33. People may have an inflated view of their own looks: The participants in the study were each asked to rate their own attractiveness on a scale from 1–10, and the average answer was 6.6.