Instructions:
This exam contains 33 Multiple Choice questions. Each question is worth 3 points, for a total of 99 points. One point will be given for bringing your ID to the exam as well as filling in your name, UF ID#, and test code on your scantron correctly.

Please 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. You must submit the scantron sheet for you to receive a grade on the exam. You must show the copy of the exam to the test room proctors before turning in your scantron.

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

Signature: ____________________________________________

<table>
<thead>
<tr>
<th>Case</th>
<th>parameter</th>
<th>estimator</th>
<th>standard error</th>
<th>Estimate of standard error</th>
<th>Sampling Distribution</th>
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<tr>
<td>one mean</td>
<td>$\mu$</td>
<td>$\bar{x}$</td>
<td>$\sigma/\sqrt{n}$</td>
<td>$s/\sqrt{n}$</td>
<td>$t(n-1)$</td>
</tr>
<tr>
<td>one prop.</td>
<td>$p$</td>
<td>$\hat{p}$</td>
<td>$\sqrt{p(1-p)}/\sqrt{n}$</td>
<td>$C.I:\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$</td>
<td>$z$</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>$S.T:\sqrt{\frac{P_0(1-P_0)}{n}}$</td>
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\[ n = \frac{\hat{p}(1-\hat{p})z^2}{m^2} \quad n = \left(\frac{zs}{m}\right)^2 \]
1. Suppose that you wanted to estimate the typical amount spent on travel expenses by students at UF during the winter break. You expect that the data ranges from 50 to 2,000 dollars. You want to make a 95% confidence interval, with a margin of error equal to 100. What sample size do you need?
   a.) 13
   b.) 21
   c.) 41
   d.) 4058

\[ Z = 1.96 \]
\[ n = \left( \frac{Z}{3} \right)^2 = \left( \frac{1.96}{3} \right)^2 = 0.37^2 = 40.5 \]

2. A psychic claims that they can predict the outcome of a 12 sided dice. In order to test this, you test to see if there is evidence that the probability that the side of the dice is predicted correctly is more than 1/12. The psychic correctly identifies the side of the dice 15 out of the 100 times. For the null hypothesis Ho:p = \frac{1}{12}, what is the test statistic?
   a.) 2.41
   b.) 4.44
   c.) 1.96
   d.) -2.41
   e.) -4.44

\[ p = \frac{15}{100} \]
\[ p_0 = \frac{1}{12} \]
\[ TS = \frac{p - p_0}{\sqrt{p_0(1-p_0)}} \]
\[ = \frac{\left( \frac{15}{100} \right) - \left( \frac{1}{12} \right)}{\sqrt{\left( \frac{1}{12} \right) \left( 1-\frac{1}{12} \right) \left( \frac{1}{100} \right) \left( \frac{11}{12} \right)}} \]
\[ = 2.41 \]

3. A student was interested in determining why students might exercise. He asked students if the most important reason that they exercised was for increased energy. He conducted a survey of randomly selected students and computed a 95% confidence interval. The 95% confidence interval was (0.16, 0.29). Is the following interpretation correct or incorrect?

"The probability that someone exercises for increased energy is between 0.16 and 0.29, 95% of the time."

a.) This is a correct statement.

b.) This is an incorrect statement.

4. Heather randomly selected 23 Ohio State University students. She asked each person to report their college GPA.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>N*</th>
<th>Mean</th>
<th>SE Mean</th>
<th>StDev</th>
<th>Minimum</th>
<th>Q1</th>
</tr>
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<tbody>
<tr>
<td>What is your current GPA</td>
<td>23</td>
<td>1</td>
<td>3.3073</td>
<td>0.0806</td>
<td>0.3866</td>
<td>2.8000</td>
<td>3.0000</td>
</tr>
</tbody>
</table>

What parameter might you estimate with this data?

a.) the sample mean GPA for Ohio State University students
b.) the sample proportion GPA for Ohio State University students
c.) the population mean GPA for Ohio State University students
d.) the population proportion GPA for Ohio State University students
5. A political scientist was interested in determining if there was enough support for a new constitutional amendment on property taxes. He wanted to see if there was evidence that more than $\frac{2}{3}$ of the state of Florida would support the new constitutional amendment. Let $p$ equal the population proportion of voters in Florida who would support the new constitutional amendment. For the null hypothesis

$H_0: \ p = \frac{2}{3}$, what would his alternative hypothesis?

a.) $H_a: \ p < \frac{2}{3}$  

b.) $H_a: \ p > \frac{2}{3}$  

c.) $H_a: \ \hat{p} = \frac{2}{3}$  

d.) $H_a: \ \hat{p} < \frac{2}{3}$  

e.) $H_a: \ \hat{p} > \frac{2}{3}$

Hypothesis statements are always about parameters

6. Suppose that you took a random sample of 28 students on campus and asked them if they planned on attending “Sweeney Todd” at the theatre on campus. Out of the 28 students, 5 said yes. Can you make a confidence interval of the population proportion of UF students that plan on attending “Sweeney Todd?”

a.) Yes, since you took a random sample, you can always make a CI.

b.) Yes, if you use the sample proportion where you add 2 successes and 2 failures and then compute the confidence interval.

c.) Yes, if you use the sample proportion where you add 10 successes and 20 failures and then compute the confidence interval.

d.) Yes, you can compute the large sample confidence interval with the sample proportion equal to $\frac{\hat{x}}{n}$.

7. What type of data is collected for a confidence interval for the population proportion?

a.) Categorical – binary responses  

b.) Quantitative – numerical responses

8. In an exit poll for a recent governor election, a political pollster tested to see if there was evidence that the Republican candidate would win. When he tested the alternative hypothesis that the population proportion of Floridians that would vote for the Republican candidate was greater than 0.5, he found the p-value of 0.031. Finish the following sentence.

"With a p-value equal to 0.031, ..."

a.) We have strong statistically significant evidence that the population proportion of Floridians who would vote for the Republican candidate is greater than 0.50.

b.) We have no statistically significant evidence that the population proportion of Floridians who would vote for the Republican candidate is greater than 0.50.

c.) We have strong statistically significant evidence that the sample proportion of Floridians who would vote for the Republican candidate is greater than 0.50.

d.) We have no statistically significant evidence that the sample proportion of Floridians who would vote for the Republican candidate is greater than 0.50.
9. For the population of people who suffer occasionally from knee pain, suppose that \( p = 0.35 \) is the proportion of people that receive relief from a knee brace. A random sample of 75 knee pain sufferers was obtained. What is the standard error of the sampling distribution of the sample proportion of people that get relief?

\[
p = \frac{0.35}{\sqrt{\frac{0.35(1-0.35)}{75}}} = 0.0551
\]

- a) 0.0551
- b) 0.35
- c) 4.13
- d) 8.66

**Questions 10 – 13** In 2014, the population mean credit card debt for US households was $15,607. The population standard deviation was $10,601. Suppose that you took a random sample of 100 people.

\[\mu = 15,607 \quad n = 100 \quad \sigma = 10,601\]

10. What would be the approximate distribution of the sampling distribution of the sample mean?

- a) Binomial
- b) Normal
- c) Both Binomial and Normal
- d) Unknown Distribution

If \( n \geq 30 \) or \( X \) is Normally distributed, \( \bar{X} \) will have an approximately Normal distribution.

In this case, \( n = 100 \), so \( \bar{X} \sim N\)

11. What would be the most likely shape of the distribution of the credit card debt for all US households?

- a) Symmetric
- b) Right Skewed
- c) Left Skewed

We should be able to go 3 std dev to the left and right if Normal. If we try to go 3 std dev to left, we get a negative value (15607 - 3(10601) = -10,196. This is not a possible value so it is not Normal. In fact, the distribution must be to the right.

12. What would be the standard error of the sampling distribution of the sample mean?

\[
\frac{10601}{\sqrt{100}} = 1060.1
\]

- a) 10601
- b) 1060.1
- c) 15607
- d) 1560.7

13. What would be the probability that the sample mean would be more than $16,050?

- a) 0.2676
- b) 0.3372
- c) 0.4179
- d) 0.6628
- e) 0.7324

\[Z = \frac{16050 - 15607}{10601/\sqrt{100}} = 0.42\]
14. Suppose that you had a p-value of 0.0025 and α = 0.01, what decision would you make?
   a.) Reject Ha
   b.) Fail to Reject Ha
   c.) Reject Ho
   d.) Fail to Reject Ho

   Rule: p-value ≤ α Reject Ho
   p-value > α Fail to Reject Ho

   \[ 0.0025 < 0.01 \text{ Reject } H_0 \]

15. For a 90% confidence interval for the population mean, what value of \( t \) would you use? The sample size is 13.
   a.) 1.771
   b.) 1.782
   c.) 1.761
   d.) 1.645

   \[ df = n-1 = 13-1 = 12 \]

16. For the sampling distribution of the sample mean, what happens to the mean as the sample size increases?
   a.) It increases.
   b.) It decreases.
   c.) It stays the same.
   d.) It varies based on the distribution.

   The CLT states that the mean of the population distribution is equal to the mean of the sampling dist'n of \( \bar{x} \).

17. A student was interested in determining how many hours students at his university exercised per day. He conducted a survey of randomly selected students and computed a 95% confidence interval. The 95% confidence interval was (45.60, 56.22) minutes. Is the following interpretation correct or incorrect?

   "We are 95% confident that the sample mean amount of time spent exercising is between 45.60 and 56.22 minutes."

   a.) This is a correct statement.
   b.) This is an incorrect statement.

18. Which of the following is NOT a property of the t distribution?
   a.) Symmetric
   b.) Centered at zero
   c.) Approaches the shape of the normal distribution as the degrees of freedom decreases
   d.) Has fatter tails than the normal distribution
   e.) All of the above are correct.

   The t distribution approaches the Normal distribution as the df increases.
19. Mark the following statement as true or false.

"The Central Limit Theorem states that the population distribution will have an approximately Normal distribution with a large enough population size."

a.) This statement is true
b.) This statement is false.

Questions 20 – 22 In 2010, the General Social Survey included a question that asked randomly selected respondents if they were very concerned about the environment. Out of 1,408 respondents, 486 said that they were very concerned about the environment.

20. What is the 90% confidence interval for the population proportion?

- (a.) $(0.32, 0.37)$
- (b.) $(0.30, 0.39)$
- (c.) $(0.28, 0.41)$
- (d.) $(0.26, 0.43)$

21. For the confidence interval above, if we increased the confidence level and nothing else, what would happen to the width of the interval?

- (a.) It would increase.
- (b.) It would decrease.
- (c.) It would stay the same.
- (d.) It can’t be determined.

22. Besides random sampling what other assumptions, do you need to check?

- (a.) np and n(1-p) is greater than or equal to 15
- (b.) np and n(1-p) is greater than or equal to 30
- (c.) np and n(1-p) is greater than or equal to 15
- (d.) np and n(1-p) is greater than or equal to 30
- (e.) Original Population is Normal or n is greater than or equal to 30

23. What is the statistical definition of "confidence level"?

- (a.) How sure you are that the interval is from a simple random sample
- (b.) Your certainty about the interval being correct
- (c.) How correct your data is
- (d.) The probability that this method produces an interval that contains the parameter.
- (e.) All of the above.
24. What are the most desired characteristics of a point estimate?
   a.) Low bias, low standard error  
   b.) High bias, high standard error  
   c.) High bias, low standard error  
   d.) Low bias, high standard error  

See page 62 in the lab workbook

25. For the hypothesis, Ho: p = 0.3 versus Ha: p ≠ 0.3 and a test statistic equal to 1.56, what is the p-value?
   a.) 0.9406
   b.) 0.1188
   c.) 0.0784
   d.) 0.0594
   e.) 0.0392

26. Is the below statement true or false?

"The p-value is the probability that the test statistics is correct."

a.) This statement is correct.
   b.) This statement is incorrect.

The definition of the p-value is the probability that we would see a test statistic this extreme if the null hypothesis is true.

27. For the sampling distribution of the sample proportion, as n increases, what happens to the standard error?
   a.) It decreases.
   b.) It increases
   c.) It stays the same.
   d.) It varies.

\[
\text{Std. Error} \Rightarrow \sqrt{\frac{p(1-p)}{n}}
\]

This value will decrease, if n increases.

28. Suppose that you wanted to take a random sample of Gainesville residents and ask them if they planned on voting in the upcoming election. You are uncertain what proportion of Gainesville residents plan on voting in the upcoming election, but you want to make a 95% confidence interval and to have a margin of error equal to 0.05. What size sample do you need?
   a.) 196
   b.) 385
   c.) 20
   d.) 400

\[
Z = 1.96 \quad m = .05 \\
\hat{p} = .5 \\
n = \frac{(1-\hat{p})(\frac{Z^2}{m})}{p(1-p)}
\]

\[
= .5(1-.5)(\frac{1.96^2}{.05})
\]

\[
= 384.16 \quad \text{Round Up to 385}
\]
29. In September of 2014, a survey found that 29.58% of its respondents used Internet Explorer as its primary browser. The survey randomly polled 2000 people living in the US. What is the point estimate of the population proportion of people living in the US who use IE as their primary browser in Sept. 2014?
   a.) unknown
   b.) 0.2958
   c.) 2000
   d.) 591.6

30. In 2012, the General Social Survey asked respondents how many hours they spent on email per week. From the random sample, the 95% confidence interval for the population mean was (6.26, 7.80). What can we say about the population mean?
   a.) It is equal to 7 hours.
   b.) It could be equal to 7 hours.
   c.) It is higher than 7 hours.
   d.) It is lower than 7 hours.

**Questions 31-33** For a particular year, the CDC says that the population proportion (p) of Americans that will get the seasonal flu is 0.12. Suppose that a random sample of 500 Americans were selected. \[ \hat{p} = 0.12 \]
\[ n = 500 \]

31. What would be the approximate distribution of the sampling distribution of the sample proportion?
   a.) Binomial
   b.) Normal
   c.) Both Binomial and Normal
   d.) None of the above

\[ 0.12 \times 500 = 60 \checkmark \]
\[ (1 - 0.12) \times 500 = 440 \checkmark \]
\[ 15, 20 \Rightarrow \hat{p} \sim N \]

32. What would be the mean of the sampling distribution of the sample proportion?
   a.) 500
   b.) 60
   c.) 0.12
   d.) Unknown value

The mean of the sampling distribution of \( \hat{p} \) is \( p \).

33. What would be the probability that the sample proportion would be less than 0.11?
   a.) 0.68
   b.) 0.2451
   c.) 0.2877
   d.) 0.7517
   e.) 0.7486

\[ Z = \frac{0.11 - 0.12}{\sqrt{0.12(1-0.12)/500}} = -0.69 \]