Name ___________________________________ AP Statistics

Date ______________ Review for Ch 19-21

Multiple Choice

1. We have calculated a confidence interval based upon a sample of $n = 200$. Now we want to get a better estimate with a margin of error only one fifth as large. We need a new sample with n at least...

   a. 240

   b. 40

   c. 5000

   d. ~~1000~~

   e. 450

C

$n \times 25$

$\sigma = \frac{1}{5}\sqrt{\frac{\hat{p}\hat{q}}{200}}$

$\frac{1}{5}\sqrt{\frac{\hat{p}\hat{q}}{200}}$

$\sqrt{\frac{\hat{p}\hat{q}}{25 \cdot 200}}$

2. A certain population is strongly skewed to the right. We want to estimate its mean, so we will collect a sample. Which should be true if we use a large sample rather than a small one?

   I The distribution of our sample data will be closer to normal.

   II The sampling model of the sample means will be closer to normal.

   III The variability of the sample means will be greater. ?

   a. I only

   b. III only

   c. I and III only

   d. II only

   e. II and III only

3. A relief fund is set up to collect donations for the families affected by recent storms. A random sample of 400 people shows that 28% of those 200 who were contacted by telephone actually made contributions compared to only 18% of the 200 who received first class mail requests. Which formula calculates the 95% confidence interval for the difference in the proportions of people who make donations if contacted by telephone or first class mail?

Ch 22

   a. $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.28)(0.72)}{400} + \frac{(0.18)(0.82)}{400}}$

   b. $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.23)(0.77)}{400}}$

   c. $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.23)(0.77)}{200}}$

   d. $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.23)(0.77)}{200} + \frac{(0.23)(0.77)}{200}}$

   e. $(0.28 - 0.18) \pm 1.96\sqrt{\frac{(0.28)(0.72)}{200} + \frac{(0.18)(0.82)}{200}}$

Name ______________________________
Date ____________

AP Statistics
Review for Ch 19-21

4. Which is true about a 95% confidence interval based on a given sample?
   ~~I~~ The interval contains 95% of the population.
   ~~II~~ Results from 95% of all samples will lie in the interval.
   III The interval is narrower than a 98% confidence interval would be.

a. None
b. II only
c. II and III only
d. I only
e. III only

5. A truck company wants on-time delivery for 98% of the parts they order from a metal manufacturing plant. They have been ordering from Hudson Manufacturing but will switch to a new, cheaper manufacturer (Steel-R-Us) unless there is evidence that this new manufacturer cannot meet the 98% on-time goal. As a test the truck company purchases a random sample of metal parts from Steel-R-Us, and then determines if these parts were delivered on-time. Which hypothesis should they test?

a. $H_0: p < 0.98$
   $H_A: p > 0.98$

b. $H_0: p = 0.98$
   $H_A: p \neq 0.98$

c. $H_0: p = 0.98$
   $H_A: p < 0.98$

d. $H_0: p > 0.98$
   $H_A: p = 0.98$

~~e.~~ $H_0: p = 0.98$
   $H_A: p > 0.98$

Name ____________________________________ AP Statistics
Date ______________ Review for Ch 19-21

6. To plan the course offerings for the next year a university department dean needs to estimate what impact the "No Child Left Behind" legislation might have on the teacher credentialing program. Historically, 40% of this university's pre-service teachers have qualified for paid internship positions each year. The Dean of Education looks at a random sample of internship applications to see what proportion indicate the applicant has achieved the content-mastery that is required for the internship. Based on these data he creates a 90% confidence interval of (33%, 41%). Could this confidence interval be used to test the hypothesis H_0: $p = 0.40$ versus H_A: $p < 0.40$ at the $\alpha = 0.05$ level of significance?
   a. Yes, since 40% is not the center of the confidence interval he rejects the null hypothesis, concluding that the percentage of qualified applicants will decrease.
   b. No, because the dean only reviewed a sample of the applicants instead of all of them.
   c. Yes, since 40% is in the confidence interval he accepts the null hypothesis, concluding that the percentage of applicants qualified for paid internship positions will stay the same.
   d. No, because the dean should have used a 95% confidence interval.
   e. Yes, since 40% is in the confidence interval he fails to reject the null hypothesis, concluding that there is not strong enough evidence of any change in the percent of qualified applicants.

7. Suppose that a conveyor used to sort packages by size does not work properly. We test the conveyor on several packages (with H_0: incorrect sort) and our data results in a P-value of 0.016. What probably happens as a result of our testing?
   truth
   a. We reject H_0, making a Type I error.
   b. We correctly fail to reject H_0.
   c. We fail to reject H_0, committing a Type II error.
   d. We correctly reject H_0.
   e. We reject H_0, making a Type II error.

   true
   H_0: incorrect sort
   H_A: correct sort
   P-Value: .016
   Reject Null

8. We test the hypothesis that $p = 35\%$ versus $p < 35\%$. We don't know it but actually $p = 26\%$. With which sample size and significance level will our test have the greatest power?
   a. $\alpha = 0.01$, $n = 250$
   b. The power will be the same as long as the true proportion p remains 26%
   c. $\alpha = 0.03$, $n = 250$
   d. $\alpha = 0.01$, $n = 400$
   e. $\alpha = 0.03$, $n = 400$

Name ______________________________ AP Statistics
Date ____________ Review for Ch 19-21

Free Response

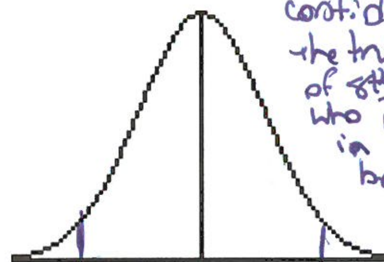
9. At a ~~large~~ suburban middle school, the participation rate of after school activities and ~~supports~~ has been 75% for eighth graders. A simple random sample of 100 eighth graders indicated that 83% of them are involved with some type of after-school activity. Determine if there is evidence of a **change** in the participation by constructing a 95% confidence interval.

p = proportion of ~~middle~~ 8th graders who participates in activities

$\hat{p} = .83$ $n = 100$

Assumptions
- Independence is assumed
- SRS is indicated
- 100 < 10% of all students — assumed (large middle school)
- $n\hat{p} = (.83)(100) = 83 \geq 10$
  $n\hat{q} = (.17)(100) = 17$

We will construct a proportion z-interval



$.7564$ $\hat{p} = .83$ $.9036$

$\sigma_{\hat{p}} = \sqrt{\frac{(.83)(.17)}{100}} = .0376$

$\hat{p} \pm z^* \sqrt{\frac{(.83)(.17)}{100}}$

$.83 \pm 1.96\sqrt{\frac{(.83)(.17)}{100}}$

$(.7564, .9036)$

We are 95% confident that the true proportion of 8th graders who participate in activities is between .7564 and .9036

There is evidence of a change in the % of 8th graders who participate in activities because .75 is not contained in our 95% interval.

10. 4. It is believed that 35% of all voters favor a particular candidate. How large of a sample is required so that the margin of error of the estimate of the percentage of all voters in favor of this candidate is less than 3% at the 95% confidence level?

$p = .35$

$m \geq z^* \sqrt{\frac{\hat{p}\hat{q}}{n}}$

use .5 since we don't know $\hat{p}$

$.03 \geq 1.96\sqrt{\frac{(.5)(.5)}{n}}$

$n \geq \left(\frac{1.96}{.03}\right)^2 (.5)^2$ $n \geq 1067.11$

$n \geq 1068$

11. LeRoy, a starting player for a major college basketball team, made 40% of his free throws last season. In the first eight games of this season, LeRoy made 25 free throws in 40 attempts.

p = proportion of free throw success
Ho: $p = .4$ LeRoy makes 40% of his free throws
Ha: $p \neq .4$ Leroy doesn't make 40% of his free throws

You want to investigate whether LeRoy's proportion of free-throw successes has **changed** this season. What conclusion would you draw at the $\alpha = 0.01$ level about LeRoy's free throw shooting? Justify your answer.

$\hat{p} = \frac{25}{40} = .625$

Assumption
- Independence is assumed
- Assume 1st 8 games are representative
- 40 attempts is less than 10% of all attempts (assumed)
- $np = .4(40) = 16 \geq 10$
  $nq = .6(40) = 24$

We will perform a 1-proportion z-test

$\sigma = \sqrt{\frac{(.4)(.6)}{40}} = .0775$

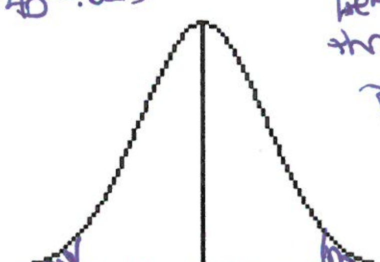
$z = \frac{.625 - .4}{.0775} = 2.90322$

P-Values

$2P(\hat{p} > .625) =$

$2P(z \leq -2.903) = 2(.0019)$

$= .0038$



$z = -2.9032$ $p = .4$ $\hat{p} = .625$

$z = 2.9032$

With a P-Value of .0038 we can reject the null hypothesis at the $\alpha = .01$ significance level.

If the true proportion of free throw successes really is .4 then we will get a sample proportion as far from that as .625 about .38% of the time. Therefore we can say that

LeRoy's free throw success rate has changed.

Name ___________________________________ AP Statistics
Date _____________ Review for Ch 19-21

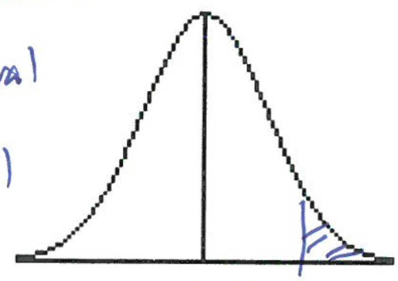
12. The governor's approval rating has remained steady at 48% throughout the fall. However, the campaign manager believes that the advertisements have led to an increased approval rating. A poll based on a sample of 1150 residents of the state showed that the governor's job approval rating stood at 55%. I this evidence that the governor's approval rating has actually increased?

a. Perform a full hypothesis test at a 5% significance level.

p = proportion of state residents who approve of the governor

H_0: p = .48 The governor's approval rating really is .48.

H_A: p > .48 The governor's approval rating is higher than .48



Assumptions
- Indepence is assumed
- An SRS is assumed
- 1150 < 10% of all state residents
- np = .48(1150) = 552 ≥ 10
  nq = .52(1150) = 598

We will perform a 1 - proportion z-test

p = .48 $\hat{p}$ = .55

$\sigma = \sqrt{\frac{(.48)(.52)}{1150}} = .0147$

$z = \frac{.55 - .48}{.0147}$

z = 4.7619

P-Value

$P(\hat{p} > .55) = P(z > 4.76) \approx 0$

Since our p-Value is virtually zero, we have very strong evidence against the null.

If the governor's approval rating is still .48, we will get a sample proportion as high as $\hat{p}$ = .55 about zero % of the time (virtually never). This is extremely unlikely. Therefore it is very likely that the governor's approval rating has increased.

b. In this context, describe a Type I error and the impact it will have on the governor's campaign. If the governor's rating has remained at 48%, and our hypothesis test indicates it has increased, we make a Type I error. This will cause the campaign to spend more money on ineffective advertising.

c. In this context, describe a Type II error and the impact it will have on the governor's campaign.

A Type II error occurs if the governor's approval rating has actually improved, but the hypothesis test shows that it hasn't. The impact here is that the campaign will choose to stop using effective advertising and the governor may lose the election as a result.

Name ____________________________________ AP Statistics
Date ______________ Review for Ch 19-21