AP Stats
Chap 18-20
Practice Test

Name KEY Pd

SECTION I

Number of Questions — 20
Percent of Total Grade — 75

Directions: Solve each of the following problems, using the available space (or extra paper) for scratchwork. Decide which is the best of the choices given and place that letter on the ScanTron sheet. No credit will be given for anything written on these pages for this part of the test. Do not spend too much time on any one problem.

Determine whether the Normal model may be used to describe the distribution of the sample proportions. If the Normal model may be used, list the conditions and explain why each is satisfied. If Normal model may not be used, explain which condition is not satisfied.

1. In a large statistics class, the professor has each student toss a coin 54 times and calculate the proportion of tosses that come up tails. The students then report their results, and the professor plots a histogram of these several proportions. May a Normal model be used here? 1. D

   A. A Normal model may be used:
   The 10% condition is satisfied: the sample size, 54, is more than 10% of the population of all coin flips.
   The success/failure condition is satisfied because np = 27 = nq = 27 which are both greater than 10

   B. A Normal model may not be used because the success/failure condition is not satisfied: np= 27 = nq = 27 which are not less than 10

   C. A Normal model may not be used because the 10% condition is not satisfied: the sample size, 54, is more than 10% of the population of all coin flips.

   D. A Normal model may be used: should check!
   Coin flips are independent of one another – no need to check the 10% condition. The success/failure condition is satisfied because np = 27 = nq = 27 which are both greater than 10

   E. A Normal model should not be used because the population distribution is not Normal.

Find the mean of the sample proportion.

2. Based on past experience, a bank believes that 6% of the people who receive loans will not make payments on time. The bank has recently approved 300 loans. What is the mean of the proportion of clients in this group who may not make timely payments? 2. E

   categorical

   A. $\mu = 4.24\%$

   B. $\mu = 1.37\%$

   C. $\mu = 18\%$

   D. $\mu = 3\%$

   E. $\mu = 6\%$

Find the standard deviation of the sample proportion. categorical $SD = \sqrt{\frac{PQ}{N}} = \sqrt{\frac{(.44)(.56)}{200}}$

3. A realtor has been told that 44% of homeowners in a city prefer to have a finished basement. She surveys a group of 200 homeowners randomly chosen from her client list. Find the standard deviation of the proportion of homeowners in this sample who prefer a finished basement. 3. B

A. $\sigma = 0.5$ % B. $\sigma = 3.5$% C. $\sigma = 44$% D. $\sigma = 0.44$% E. $\sigma = 1.7$%

In a large class, the professor has each person toss a coin several times and calculate the proportion of his or her tosses that come up heads. The students then report their results, and the professor plots a histogram of these proportions. Use the 68–95–99.7 Rule to provide the appropriate response.

4. If each student tosses the coin 200 times, about 99.7% of the sample proportions should be between what two numbers? 4. D

3 SDs

A. 0.0015 and 0.9985

B. 0.4925 and 0.5075

C. 0.00075 and 0.99925

D. 0.394 and 0.606

E. 0.106 and 0.1414

$\mu = .5$

$SD = \sqrt{\frac{(.5)(.5)}{200}} = 0.35$

$.5 \pm 3(.035) = (.39, .61)$

Find the specified probability, from a table of Normal probabilities. Assume that the necessary conditions and assumptions are met.

μ categorical

5. Based on past experience, a bank believes that 7% of the people who receive loans will not make payments on time. The bank has recently approved 300 loans. What is the probability that over 8% of these clients will not make timely payments? 5. C

normalcdf(.67,100)

A. 0.496 B. 0.504 C. 0.248 D. 0.68 E. 0.752

$SD = \sqrt{\frac{(.07)(.93)}{300}} = .015$ $z = \frac{.08-.07}{.015} = 0.67$

6. The weights of the fish in a certain lake are normally distributed with a mean of 13 lb and a standard deviation of 12. If 16 fish are randomly selected, what is the probability that the mean weight will be between 10.6 and 16.6 lb? 6. A

A. 0.6730 B. 0.4032 C. 0.0968 D. 0.5808 E. 0.3270

7. A hair stylist believes the distribution of her tips has a model that is slightly skewed to the right, with a mean of \$10.50 and a standard deviation of \$6.25. What is the probability that her 15 clients this weekend will tip an average of less than \$12? 7. C

A. 0.2371 B. 0.4052 C. 0.8238 D. 0.5948 E. 0.1762

Answer the question. Categorical

8. A candy company claims that 17% of the jelly beans in its spring mix are pink. Suppose that the candies are packaged at random in bags containing about 400 jelly beans. A class of students opens several bags, counts the various colors of jelly beans, and calculates the proportion that are pink. In one bag, the students found 14% of the jelly beans were pink. Is this an unusually small proportion of pink jelly beans? Explain your response. 8. E

   A. This is an unusual result. It is 2.07 standard deviations below the mean.

   B. This is not an unusual result. It is only 0.05 standard deviations below the mean.

   C. This is a very unlikely result. It is 3.81 standard deviations below the mean.

   D. This is not an unusual result. It is only 0.21 standard deviations below the mean.

   E. This is not an unusual result. It is only 1.60 standard deviations below the mean.

   close enough

   $SD = \sqrt{\frac{(.17)(.83)}{400}} = 0.019$

   $z = \frac{.14-.17}{.019} =$

   $z = -1.58$

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion.

9. When 252 college students are randomly selected and surveyed, it is found that 115 own a car. Construct a 99% confidence interval for the percentage of all college students who own a car. 9. E

   A. (40.5%, 50.8%)

   B. (39.5%, 51.8%)

   C. (38.3%, 52.9%)

   D. (25.3%, 66.0%)

   E. (37.6%, 53.7%)

   1-Prop Z-int
   x: 115
   N: 252
   C-level: .99

10. Of 362 randomly selected medical students, 29 said that they planned to work in a rural community. Construct a 95% confidence interval for the percentage of all medical students who plan to work in a rural community. 10. E

   A. (5.66%, 10.4%)

   B. (4.69%, 11.3%)

   C. (7.00%, 9.02%)

   D. (4.34%, 11.7%)

   E. (5.21%, 10.8%)

   1-Prop Z-int
   X: 29
   N: 362
   C-Level = .95

Find the margin of error for the given confidence interval.

11. In a survey of 7200 T.V. viewers, 40% said they watch network news programs. Find the margin of error for this survey if we want 95% confidence in our estimate of the percent of T.V. viewers who watch network news programs. (Note: 95% confidence level, $z^* = 1.96$) 11. B

   A. 0.4% B. 1.13% C. 1.48% D. 0.848% E. 1.30%

Solve the problem.

12. A university's administrator proposes to do an analysis of the proportion of graduates who have not found employment in their major field one year after graduation. In previous years, the percentage averaged 13%. He wants the margin of error to be within 4% at a 99% confidence level. What sample size will suffice? (Note: 99% confidence level, $z^* = 2.58$) 12. D

   A. 191.4 B. 272 C. 19 D. 469 E. 563

Provide an appropriate response.

13. In a survey of 1,000 television viewers, 40% said they watch network news programs. For a 90% confidence level, the margin of error for this estimate is 2.5%. If we want to be 95% confident, how will the margin of error change? 13. D

A. Since more confidence requires a more narrow interval, the margin of error will be smaller.

B. Since more confidence requires a more narrow interval, the margin of error will be larger.

C. Since more confidence requires a wider interval, the margin of error will be smaller.

D. Since more confidence requires a wider interval, the margin of error will be larger.

E. There is not enough information to determine the effect on the margin of error.

14. We have calculated a 95% confidence interval and would prefer for our next confidence interval to have a smaller margin of error without losing any confidence. In order to do this, we can 14. C

I. change the z^* value to a smaller number. z^* is associated w/ confidence %

II. take a larger sample.

III. take a smaller sample.

A. III only   B. I and II   C. II only   D. I and III   E. I only

15. Which is true about a 98% confidence interval for a population proportion based on a given sample? 15. E

I. We are 98% confident that ~~other sample~~ our true proportions will be in our interval.

II. There is a 98% ~~chance~~ that our interval contains the population proportion.

III. The interval is wider than a 95% confidence interval would be.

A. None   B. I only   C. I and II   D. II only   E. III only

Write the null and alternative hypotheses you would use to test the following situation.

16. The federal guideline for smog is 12% pollutants per 10,000 volume of air. A metropolitan city is trying to bring its smog level into federal guidelines. The city comes up with a new policy where city employees are to use of city transportation to and from work. A local environmental group does not think the city is doing enough and no real change will occur. An independent agency, hired by the city, runs a test on the air. What are the null and alternative hypotheses? 16. A

A. H_0: $p = 0.12$
H_A: $p \neq 0.12$

is it different?

$\neq$

B. H_0: $p = 0.12$
H_A: $p > 0.12$

C. H_0: $p = 0.12$
H_A: $p < 0.12$

D. H_0: $p \neq 0.12$
H_A: $p = 0.12$

E. H_0: $p < 0.12$
H_A: $p > 0.12$

17. A new manager, hired at a large warehouse, was told to reduce the 26% employee sick leave. The manager introduced a new incentive program for employees with perfect attendance. The manager decides to test the new program to see if it's better. What are the null and alternative hypotheses? 17. A

less than

<

A. H_0: $p = 0.26$
   H_A: $p < 0.26$

B. H_0: $p = 0.26$
   H_A: $p \neq 0.26$

C. H_0: $p = 0.26$
   H_A: $p > 0.26$

D. H_0: $p > 0.26$
   H_A: $p < 0.26$

E. H_0: $p < 0.26$
   H_A: $p = 0.26$

Create a 95% confidence interval for the given data.

less than

18. A company hopes to improve its engines, setting a goal of no more than 3% of customers using their warranty on defective engine parts. A random survey of 1400 customers found only 30 with complaints. Create a 95% confidence interval for the true level of warranty users among all customers. 18. E

A. Based on the data, we are 95% confident the true proportion of warranty users is between 1.4% and 3.8%. Therefore, the company has not met its goal.

B. Based on the data, we are 95% confident the true proportion of warranty users is between 2.0% and 2.9%. Therefore, the company has met its goal.

C. Based on the data, we are 95% confident the true proportion of warranty users is between 1% and 3%. Therefore, the company has met its goal.

D. Based on the data, we are 95% confident the true proportion of warranty users is between 0% and 2.9%. Therefore, the company has met its goal.

E. Based on the data, we are 95% confident the true proportion of warranty users is between 1.4% and 2.9%. Therefore, the company has met its goal.

(1) 1-Prop Z test
P_0 : .03
X : 30
N : 1400
prop < P_0

p-value = .03

reject H_0 !

(2) 1-Prop Z-int (.0138, .0290)

Provide an appropriate response.

19. A weight loss center provided a loss for 72% of its participants. The center's leader decides to test a new weight loss strategy on a random sample size of 140 and found weight loss in 78% of the participants. Test an appropriate hypothesis and state your conclusion. Be sure the appropriate assumptions and conditions are satisfied before you proceed. 19. E

X A. H_0: $p = 0.72$; H_A: $p < 0.72$; $z = -1.54$; P-value = 0.9382. This data shows a weight loss in more than 72% of the participants in the weight loss strategy; the manager should continue strategies.

B. H_0: $p = 0.72$; H_A: $p > 0.72$; $z = -1.54$; P-value = 0.0618. This data does not show a weight loss decrease in more than 72% of the participants in the weight loss strategy; the manager should change strategies.

X C. H_0: $p = 0.72$; H_A: $p < 0.72$; $z = 1.54$; P-value = 0.9382. This data shows a weight loss in more than 72% of the participants in the weight loss strategy; the manager should continue strategies.

X D. H_0: $p = 0.72$; H_A: $p \neq 0.72$; $z = 1.54$; P-value = 0.1236. This data does not show a weight loss in more than 72% of the participants in the weight loss strategy; the manager should continue strategies.

close enough!

E. H_0: $p = 0.72$; H_A: $p > 0.72$; $z = 1.58$; P-value = 0.0571. This data does not show a weight loss in more than 72% of the participants in the weight loss strategy; the manager should change strategies.

needs to have (+) z-score since using 1-tail upper tail test

1-Prop Z-test
p_0 : 0.72
X : 109
N : 140
prop > p_0

p-value = .061
z-score = 1.54

20. A pharmaceutical company investigating whether drug stores are less likely than food markets to remove over-the-counter drugs from the shelves when the drugs are past the expiration date found a P-value of 2.8%. This means that: 20. E

A. 97.2% more drug stores remove over-the-counter drugs from the shelves when the drugs are past the expiration date than drug stores.

B. 2.8% more drug stores remove over-the-counter drugs from the shelves when the drugs are past the expiration date.

C. There is a 97.2% chance the drug stores remove more expired over-the-counter drugs.

D. There is a 2.8% chance the drug stores remove more expired over-the-counter drugs.

$\boxed{\text{E.}}$ None of these.

p-value = .028

reject the null that says drug stores + food markets remove drugs equally

There is evidence that the drug stores will remove expired drugs from shelves.

→ but don't know % of chance % of stores

(6) $SD = \frac{\sigma}{\sqrt{n}} = \frac{12}{\sqrt{16}} = 3$

$z = \frac{10.6 - 13}{3} = -.8$

$z = \frac{16.6 - 13}{3} =$

normalcdf(-.8, 1.2) = .6731

(11) $ME = (z^*)\left(\sqrt{\frac{PQ}{n}}\right)$

$= (1.96)\left(\sqrt{\frac{(.40)(.60)}{7200}}\right)$

$= .0113$

90

95% → 1.96

98% → 2.326

99% → 2.58

(7) $SD = \frac{\sigma}{\sqrt{n}} = \frac{6.25}{\sqrt{15}} = 1.614$

$P(X < \$12) = ?$

$z = \frac{12 - 10.50}{1.614} = 0.929$

$P(Z < 0.929) =$

normalcdf (-100, 0.929) =

0.824

(12) $ME = (z^*)\left(\sqrt{\frac{pq}{n}}\right)$

$.04 = (2.58)\left(\sqrt{\frac{(.13)(.87)}{n}}\right)$

$n = 470.5$

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(13) more confidence = wider interval = larger ME = less precision

less confidence = smaller interval = smaller ME = greater precision

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(14) Keeping confidence %...

smaller ME = larger sample

larger ME = smaller sample

SECTION II
Part A
Questions 21-22
Percent of Total Grade – 50

Directions: Show all of your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy of your results and explanations.

Twins.

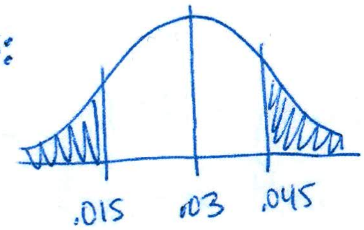
21. In 2001 a national vital statistics report indicated that about 3% of all births produced twins. Is the rate of twin births the same among very young mothers? Data from a large city hospital found only seven sets of twins were born to 469 teenage girls. Test an appropriate hypothesis and state your conclusion.

Hyp H_0: $p = .03$ The percentage of twin births to teenage girls @ this hospital is 3%

H_A: $p \neq .03$ The percentage of twin births to teenage girls @ this hospital is not 3%

Model: The likelihood of one mother having twins is independent from all others. This sample may not be random, so we assume that these teen mothers chosen are representative of all teen mothers. 469 is assumed to be less than 10% of all teen mothers. $np = (469)(.03) = 14.07$ and $nq = (469)(.97) = 455$, both are ≥ 10. We can use a 1-Prop Z Test with two tails.

Mechanics:



$\hat{p} = \frac{7}{469} = .015$

1-PropZTest
p_0: .03
x: 7
n: 469
prop $\neq p_0$

pvalue = .0556

Conclusion: With a pvalue of .0556, we can fail to reject (with caution) the null. There might not be any evidence that the percentage of teen moms @ this hospital is different than the overall percentage.

We are 95% confident that the real % of teen moms w/twins is between .00395 and .0259

The NFL.

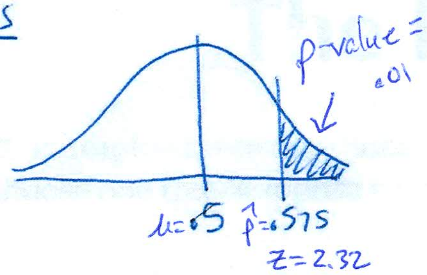
22. During the ~~200~~ 2000 season, the home team won 138 of the 240 regular season National Football League games. Is this strong evidence of a home field advantage in professional football? Test an appropriate hypothesis and state your conclusion.

Hyp: H_0: $p = .50$ Our null hypothesis is that a team will win half of their home games

H_A: $p > .50$ Our alternative is that the home team will win more than half their games

Model: The probability of winning a home game should be independent of the others. This 2000 season should be representative of all other seasons. 240 games is less than 10% of all games in all seasons. $np = (240)(.50) = 120$, $nq = (240)(.50) = 120$; both are ≥ 10. We will use a 1-Prop ZTest, upper tailed.

Mechanics



$\hat{p} = \frac{138}{240} = .575$

$SD = \sqrt{\frac{(.5)(.5)}{240}} = .032$

1-PropZTest
p_0: .50
x: 138
n: 240
prop $> p_0$

pvalue = .010
$z = 2.32$

Conclusion: With a pvalue of .01, we reject the null. There is strong evidence that in 2000, the home team had an advantage. We are 95% confident that the true proportion of home team wins is between .512 and .638.