

## Exam 2, Fall 2016

- 1) The center of a 95% confidence interval for the population mean is a random variable.
  - a) True
  - b) False
- 2) A 95% confidence interval contains 95% of the population.
  - a) True
  - b) False
- 3) For the following situation, can the normal distribution be used to compute the answer?  
Weights of adults have mean 150 lbs and standard deviation 25 lbs. We want to know the probability that the average weight of 50 randomly selected people is more than 200 pounds.
  - a) True
  - b) False
- 4) For the following situation, can the normal distribution be used to compute the answer?  
Salaries at a large corporation have mean of \$40,000 and standard deviation of \$20,000. We want to know the probability that a randomly selected employee makes more than \$50,000.
  - a) True
  - b) False
- 5) A type II error is the error that is committed if the null hypothesis is rejected when in fact it is true.
  - a) True
  - b) False
- 6) In stating the null and alternative hypotheses, the equal sign is always placed in the null hypothesis.
  - a) True
  - b) False
- 7) When  $s$  is unknown, the chi-square distribution is used to construct confidence intervals on the population mean.
  - a) True
  - b) False

- 8) The null hypothesis that two population variances are equal against a two sided alternative will tend to be rejected if the ratio of the sample variances from each population is substantially larger than 1.0.
- a) True
  - b) False
- 9) When are p-values negative?
- a) When the test statistic is negative.
  - b) When the sample statistic is smaller than the proposed value of the parameter
  - c) When the confidence interval includes only negative values
  - d) When we fail to reject the null hypothesis
  - e) Never
- 10) Random samples are taken from two different populations. A sample of size  $n_1$  is taken from population 1, which has a population standard deviation of  $\sigma_1$ . A sample of size  $n_2 = 2n_1$  is taken from population two, which has a population standard deviation of  $\sigma_2 = 2\sigma_1$ . In which of the two samples would you expect the estimate of the population mean to be more accurate?
- a) Sample 1
  - b) Sample 2
  - c) They are equivalent
- 11) Suppose that the probability that a Harvard basketball player makes a free throw is  $p = 0.75$ . Now suppose that he shoots 100 free throws over the course of a basketball season (sample of 100 independent free throws). Find the approximate probability that he makes less than 65% of his free throws during the course of the season.
- a) 0.0104
  - b) 0.9896
  - c) 0.4093
  - d) 0.5912
  - e) 0.0407
- 12) A random sample of married people were asked "Would you remarry your spouse if you were given the opportunity for a second time?"; Of the 150 people surveyed, 127 of them said that they would do so. Find a 95% confidence interval for the proportion of married people who would remarry their spouse.
- a)  $0.847 \pm 0.002$
  - b)  $0.847 \pm 0.029$
  - c)  $0.847 \pm 0.048$
  - d)  $0.847 \pm 0.058$
  - e)  $0.847 \pm 0.113$

- 13) Suppose the average weight for adult males (age 18 or older) in Alachua County is 190 lbs with a standard deviation of 20. Now suppose we take a random sample of 143 adult males (age 18 or older) in Alachua County. What is the probability that the average weight of our 143 subjects is bigger than 193 lbs?
- a) 0.0952
  - b) 0.0364
  - c) 0.3258
  - d) 0.4271
  - e) 0.1270
- 14) If you wanted to estimate the true percentage of all voters in Canada who are in favor of merging with the United States to create Canmerica™, and if you wanted your maximum error of estimate to be  $\pm 5\%$  with a confidence level of 95%, what would the required sample size be?
- a) 267
  - b) 1068
  - c) 385
  - d) 4272
  - e) 723
- 15) A researcher wishes to compare the proportion of men and women who voted in the last federal election. Which of the following conclusion could NOT be drawn as the result of any hypothesis test. "At the given level of significance, we have evidence..."
- a) "... that the proportion of men who voted is larger than the proportion of women who voted."
  - b) "... that the proportion of men who voted differs from the proportion of women who voted."
  - c) "... that the proportion of men who voted does not differ from the proportion of women who voted."
  - d) "... that the proportion of men who voted is smaller than the proportion of women who voted."
  - e) None of the above (each statement a-d is a possible conclusion).
- 16) A study was conducted to evaluate the stress level of senior business students at a particular college. Fifty students were selected at random from the senior business class, and their stress level was monitored by attaching an electrode to the frontalis muscle (forehead). For the fifty students, the mean EMG (electromyogram) activity was found to be 35.8 microvolts. In addition, the standard deviation of the EMG readings was found to be 2.5 microvolts. What would be the 95% confidence interval for the true mean EMG activity for all seniors in the class?
- a) (30.9,40.7)
  - b) (35.1,36.5)
  - c) (34.4,37.2)
  - d) (35.6,35.9)
- 17) A telephone company wants to estimate the mean number of minutes people in a city

spend talking long distance with 95% confidence. From past records, an estimate of the standard deviation is 12 minutes. What is the minimum sample size required if the desired width of the confidence interval is 10 minutes?

- a) 28
- b) 11
- c) 23
- d) 19
- e) 42

18) To test whether or not two population variances are equal, the appropriate distribution is:

- a) Normal distribution
- b) Chi-square distribution
- c) F distribution
- d) t distribution

19) The owner of a hotdog stand claims that the mean attendance at Trump rallies is over 72,100, and she is therefore justified in enlarging her stand before the next rally. Identify the type II error for the test.

- a) Reject the claim that the mean attendance is equal to 72,100, when it is actually less than 72,100.
- b) Fail to reject the claim that the mean attendance is equal to 72,100, when it is actually over 72,100.
- c) Reject the claim that the mean attendance is equal to 72,100 when it is actually 72,100.
- d) Fail to reject the claim that the mean attendance is more than 72,100, when it is actually less than 72,100.

20) An unbiased estimator of a population parameter is defined as:

- a) An estimator whose expected value is equal to the parameter
- b) An estimator whose variance is equal to one
- c) An estimator whose expected value is equal to zero
- d) An estimator whose variance goes to zero as the sample size goes to infinity

21) Suppose 5% of trucks of a certain model have needed new engines after being driven between 0 and 100 miles. The manufacturer hopes that the redesign of one of the engine's components has solved this problem. If  $p$  represents the population proportion of trucks that need new engines, what is the appropriate hypothesis for the manufacturer to test?

- a)  $H_0: p = 0.05$     $H_a: p > 0.05$
- b)  $H_0: p < 0.05$     $H_a: p = 0.05$
- c)  $H_0: p < 0.05$     $H_a: p > 0.05$
- d)  $H_0: p = 0.05$     $H_a: p < 0.05$
- e)  $H_0: p > 0.05$     $H_a: p = 0.05$

22) The width of a confidence interval estimate of the population mean increases when the:

- a) Level of confidence increases
- b) Sample size decreases
- c) Value of the population standard deviation increases
- d) All of these choices are true

23) Which of the following statements is (are) true about the t-distribution with k degrees of freedom?

- i. The t-distribution is symmetric.
- ii. The t-distribution with k degrees of freedom has a smaller variance than the t-distribution with k+1 degrees of freedom.
- iii. The t-distribution has a larger variance than the standard normal (z) distribution

- 1) I only
- 2) II only
- 3) III only
- 4) I and II
- 5) I and III

24) A music producer is interested in marketing a new artist via ads in movie theaters. The target age group is teenagers from 14-18 years of age. The company developing the advertisement has offered to run the ad in conjunction with the following types of movies: 20% of the time with comedies, 50% with dramas, and 30% with action films. However, the movie producer is not sure these percentages reflect the types of movies that teens attend. To investigate, each person in a random sample of teens was asked what type of movie they had seen most recently, resulting in the following data. Compute the value of the Chi-square goodness of fit statistic.

**Movie Most Recently Watched By 100 Teens**

	Comedy	Drama	Action
Observed Count	41	35	24

- a) 12.12
- b) 16.91
- c) 4.24
- d) 38.32
- e) 27.75

25) In a recent Gallup poll on a random sample of 1,028 US adults, 11% said they approve of the way the Congress is handling its job, with a 95% confidence interval of 7% to 15%. Which of the following statements is/are true based on the confidence interval?

- (i) The population proportion is 0.11.
- (ii) The sample proportion is 0.11.
- (iii) The margin of error is 0.04.
- (iv) 95% of random samples will have sample means between 0.07 and 0.15.

- a) They all are true
- b) None of them are true
- c) (i), (iii) and (iv) are true
- d) (ii) and (iv) are true
- e) (ii) and (iii) are true

26) The Florida Fruit Supply Company uses bottles that are labeled as containing 23 oz of orange juice. A random sample of 32 such bottles shows that the sample mean and standard deviation are 22.75 oz and 0.64 oz, respectively. What is the test statistic for testing  $H_0: \mu = 23$   $H_a: \mu \neq 23$

- a) -0.39
- b) 2.21
- c) -2.21
- d) 1.96
- e) 0.39

27) What is the decision for the hypothesis test described above?

- a) Reject the null hypothesis
- b) Fail to reject the null hypothesis

28) A random sample of 600 high school wrestlers showed that 78 had taken diet pills during the past 30 days to lose weight. The researcher wants to test the hypothesis that the true proportion of all high school wrestlers who take diet pills to lose weight is more than 10%. Using a 0.05 level of significance, what is the test statistic for  $H_0: p = 0.10$   $H_a: p > 0.10$  ?

- a) 2.19
- b) -2.45
- c) -1.48
- d) 1.96
- e) 2.45

29) What is the decision for the hypothesis test described above?

- a) Reject the null hypothesis
- b) Fail to reject the null hypothesis

- 30) Respondents who had a tree during the holiday season were asked whether the tree was natural or artificial. Respondents were also asked if they lived in an urban area or in a rural area. Of the 421 households displaying a Christmas tree, 160 lived in rural areas and 261 were urban residents. The tree growers want to know if there is a difference in preference for natural trees versus artificial trees between urban and rural households. The tree growers found that 68 of the rural households prefer a natural tree and 89 of the urban households prefer a natural tree. Does the Stata output below provide evidence that a difference exists in the preferences of rural and urban residents?

```
. prtesti 160 68 261 89, count
```

Two-sample test of proportions

Variable	Mean	Std. Err.	z	P> z	[95% Conf. Interval]
x	.425	.0390812			.3484022 .5015978
y	.3409962	.0293426			.2834857 .3985066
diff	.0840038	.0488706			-.0117807 .1797884
	under Ho:	.0485546	1.73	0.084	

diff = prop(x) - prop(y)      z = 1.7301  
Ho: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0  
Pr(Z < z) = 0.9582      Pr(|Z| < |z|) = 0.0836      Pr(Z > z) = 0.0418

Which one of the following statements is true? Because the  $p$ -value is

- greater than .05, we fail to reject the null hypothesis and can conclude that preference for natural trees for people living in rural areas is the same as for people living in urban areas.
  - greater than .05, we fail to reject the null hypothesis and cannot conclude that preference for natural trees for people living in rural areas is not the same as for people living in urban areas.
  - less than .05, we fail to reject the null hypothesis and conclude that preference for natural trees for people living in rural areas is the same as for people living in urban areas
  - less than .05, we reject the null hypothesis and cannot conclude that preference for natural trees for people living in rural areas is the same as for people living in urban areas
- 31) You have measured the systolic blood pressure of a random sample of 30 employees of a company. A 95% confidence interval for the mean systolic blood pressure for the employees is computed to be (122, 138). Which of the following statements gives a valid interpretation of this interval?

- a) 95% of the sample of employees has a systolic blood pressure between 122 and 138.
- b) 95% of the employees in the company have a systolic blood pressure between 122 and 138.
- c) If the sampling procedure were repeated 100 times, then approximately 95 of the sample means would be between 122 and 138.
- d) If the sampling procedure were repeated 100 times, then approximately 95 of the resulting 100 confidence intervals would contain the true mean systolic blood pressure for all employees of the company.
- e) We are 95% confident the sample mean is between 122 and 138.

32) A fisheries researcher wishes to test for a difference in mean weights of a single species of fish caught by fishermen in three different lakes in Nova Scotia. Suppose she collects data, runs an ANOVA and finds the  $p$ -value = 0.032. What is the appropriate interpretation of this test?

- a) Reject  $H_0$ : All three fish populations have different mean weights.
- b) Reject  $H_0$ : Exactly two of the three fish populations have the same means.
- c) Reject  $H_0$ : At least one of the fish populations differs from the others in terms of their mean weight.
- d) Fail to reject  $H_0$ : The mean weights of the fish in these three populations are the same
- e) Fail to reject  $H_0$ : There is insufficient evidence for differences in mean weights of the fish from these three populations.

33) Why is the central limit theorem important in statistics?

- a) Because for a large sample size  $n$ , it says the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
- b) Because for a large sample size  $n$ , it says the population is approximately normal.
- c) Because for any population, it says the sampling distribution of the sample mean is approximately normal, regardless of the shape of the population.
- d) Because for any sample size  $n$ , it says the sampling distribution of the sample mean is approximately normal.

34) For survey sample size calculations, when we have no information as to the value of  $p$ ,  $p=.50$  is used because

- a) The value of  $p(1-p)$  is at its maximum value at  $p=.50$
- b) The value of  $p(1-p)$  is at its minimum value at  $p=.50$
- c) The estimate of  $p=.50$  is a valid point estimate of the sample proportion.
- d) The allowable or tolerable sampling error is .50.



- 35) Researchers are interested in whether the effects of DDT poisoning in rats are less extreme in males. A simple random sample (SRS) of 100 male rats and an independent SRS of 100 female rats are obtained. The male rats had a sample mean of 39 and a sample standard deviation of 8. The female rats had a sample mean and standard deviation of 40 and 10, respectively. Let  $u_1$  represent the true mean response for the males and  $u_2$  represent the true mean response of the females. They test the following hypotheses,  $H_0 : u_1 = u_2$ ,  $H_a : u_1 < u_2$

The numerical value of the test statistic is

```
. ttesti 100 39 8 100 40 10
```

Two-sample t test with equal variances

	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
x	100	39	.8	8	37.41263	40.58737
y	100	40	1	10	38.01578	41.98422
combined	200	39.5	.6396843	9.046502	38.23857	40.76143
diff		-1	1.280625		-3.525415	1.525415
diff = mean(x) - mean(y)				t = -0.7809		
Ho: diff = 0				degrees of freedom = 198		
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.2179		Pr( T  >  t ) = 0.4358		Pr(T > t) = 0.7821		

- a) 0.78
- b) 0.44
- c) 0.22
- d) -0.78
- e) -1.0

- 36) Suppose  $X_1$  and  $X_2$  are independent random variables from a Normal distribution with mean  $\mu$  and variance  $\sigma^2$ . It turns out that both  $\bar{X} = .5(X_1 + X_2)$  and  $\tilde{X} = .2X_1 + .8X_2$  are estimators of  $\mu$ . What is  $\left[Var(\bar{X})/Var(\tilde{X})\right] + 0.5\left[E(\bar{X}) - E(\tilde{X})\right]$ ?

- a) 0.42
- b) 0.74
- c) 0.51
- d) 1.17
- e) 1.39

- 37) Do out-of-state motorists violate the speed limit more frequently than in-state motorists? This vital question was addressed by the highway patrol in a large eastern state. A random sample of the speeds of 2,500 randomly selected cars was categorized according to whether the car was registered in the state or in some other state and whether or not the car was violating the speed limit. The data follow. What is the numerator of the test statistic to compare these two proportions? Assume group 1 is In State Cars.

	In State Cars	Out of State Cars
Speeding	521	328
Not speeding	1141	510

- a) -0.19
- b) -0.08
- c) -0.16
- d) -0.44
- e) -1.64

Answers:

- 1) A
- 2) B
- 3) A
- 4) B
- 5) B
- 6) A
- 7) B
- 8) A
- 9) E
- 10) A
- 11) A
- 12) D
- 13) B
- 14) C
- 15) C
- 16) B
- 17) C
- 18) C
- 19) B
- 20) A
- 21) D
- 22) D
- 23) E
- 24) E
- 25) E
- 26) C
- 27) A
- 28) E
- 29) A
- 30) B
- 31) D
- 32) C
- 33) A
- 34) A
- 35) D
- 36) B
- 37) B

## Exam 2, Spring 2017

- 1) If a population is known to be normally distributed, then it follows that the sample standard deviation must equal the population standard deviation for any size sample.
  - a) True
  - b) False
- 2) The smaller the p-value, the stronger the evidence against the null hypothesis.
  - a) True
  - b) False
- 3) The larger the sample size, the more the sampling distribution of sample means resembles the shape of the population distribution.
  - a) True
  - b) False
- 4) If we fail to reject the null hypothesis ( $H_0$ ) at a significance level of  $\alpha=0.05$ , then we also must fail to reject it at a significance level of  $\alpha=0.10$ .
  - a) True
  - b) False
- 5) All t distributions have a mean of zero and a standard deviation of 1.
  - a) True
  - b) False
- 6) If a 95% confidence interval for the mean number of hours that students study per week is (18, 23), then there is a 95% chance that a randomly selected student will study between 18 to 23 hours per week.
  - a) True
  - b) False
- 7) Consider testing the hypothesis  $H_0 : \mu = 50$   $H_a : \mu \neq 50$ . If  $n = 64$ ,  $\bar{x} = 53.5$  and  $s = 10$ , then the value of the test statistic is 2.10.
  - a) True
  - b) False
- 8) If  $H_0$  is rejected, the probability of making a Type II error is 0.
  - a. True
  - b. False

9) According to the Law School Admission Council, in the fall of 2016, 66% of law School applicants were accepted to some law school. The training program LSATisfaction™ claims that 163 of the 240 students trained in 2016 were admitted to law school. You can safely consider these trainees to be representative of the population of law school applicants. What is the value of the test statistics to test if LSATisfaction™ has demonstrated a real improvement over the national percentage?

- a) 0.63
- b) 0.94
- c) 0.48
- d) 1.27
- e) 1.57

10) A student wishes to know if SUV drivers at his school are more likely to be male than female. He takes a simple random sample of 60 students from a large list of students that consists of all the SUV drivers at the school, and records the gender of each student in the sample. What would be the appropriate inference procedure to use?

- a) Two sample t-test; testing to see if the mean number of females differs from the mean number of males driving SUV's
- b) Chi-square test of independence
- c) Test for a population proportion; testing to see if the proportion of SUV drivers who are males is greater than 50%
- d) Test for the difference of two proportions; testing to see if the proportion of SUV drivers who are male is greater than the proportion of SUV drivers who are female
- e) Paired t-test

11) Which of the following is a required condition for ANOVA?

- a) The populations are not normally distributed.
- b) The population variances are equal.
- c) The samples are dependent.
- d) All of these choices are not required conditions for ANOVA.

12) A Gallup poll of 1089 adults found 326 supported the policies of a particular

political party. A 95% confidence interval for the true level of support in the entire population is:

- a) (.299, .300)
- b) (.272, .327)
- c) (.285, .313)
- d) (.267, .332)

13) A financial analyst wanted to determine the mean annual return on mutual funds. A random sample of 60 returns shows a mean of 12% and standard deviation of 4%. Give a 95% confidence interval for the mean annual return on all mutual funds.

- a) (15%, 17%)
- b) (9%, 11%)
- c) (13%, 15%)
- d) (11%, 13%)

14) The owner of a travel agency would like to determine whether or not the mean age of the agency's customers is over 24. If so, he plans to alter the destination of their special cruises and tours. If he concludes the mean age is over 24 when it is not, he makes a \_\_\_\_\_ error. If he concludes the mean age is not over 24 when it is, he makes a \_\_\_\_\_ error.

- b) Type II; Type II
- c) Type I; Type I
- d) Type I; Type II
- e) Type II; Type I

15) The mean cost of renting an apartment in a city is \$2000 per month with a standard deviation of \$300. Suppose we take a sample of 60 apartments in the city. The probability that the sample mean is larger than \$2050 is

- a) 0.0985
- b) 0.1783
- c) 0.4013
- d) 0.5987
- e) 0.9015

16) Typically about 57.5% of eligible American adults vote in presidential elections. Ted, a political science student, would like to perform a test of hypothesis to see

if this percentage is different for his classmates. He is taking a lecture class and is connected to all his classmates through Canvas. He decides to randomly select 42 of his classmates for his sample and finds 35.7% of them voted in the last presidential election. Suppose a 95% confidence interval was formed for the proportion of all his classmates that voted in the last presidential election and it was found to be (0.212, 0.502), Had he performed a two-tailed hypothesis test at a 5% significance level, would the null hypothesis have been rejected?

- a) No, since 0.357 falls inside the confidence interval.
- b) No, since 0.575 is larger than 0.05.
- c) Yes, since 0.575 falls outside of the confidence interval.
- d) Yes, since 0.05 falls outside of the confidence interval.
- e) No conclusion can be made due to insufficient information.

17) Suppose that a manufacturer is testing one of its machines to make sure that the machine is producing more than 97% good parts ( $H_0: p=0.97$  and  $H_a: p>0.97$ ). The test results in a P-value of 0.122. Unknown to the manufacturer, the machine is actually producing 99% good parts. Given that the manufacturer has chosen a significance-level of 0.05, what happens as a result of the testing?

- a) They correctly fail to reject  $H_0$ ,
- b) They correctly reject  $H_0$ .
- c) They reject  $H_0$ , making a Type I error.
- d) They fail to reject  $H_0$ , making a Type I error.
- e) They fail to reject  $H_0$ , making a Type II error.

18) A recent Pew Research Center poll of teen "sexting" trends found that 20% of U.S. teens aged 12-17 have received sexually explicit photos on their cellular phones. The poll was based on a confidence level of 95%, and reported a margin of error of  $\pm 2.5\%$ . Find the sample size used by Pew to conduct this poll.

- a) 1061
- b) 1911
- c) 722
- d) 984
- e) 865

19) In 2004, a random sample of 46 Coyotes in a region of northern Minnesota showed the average age to be 2.05 years with a standard deviation of 0.82 years. However, it is thought that the overall population mean age of coyotes is 1.75

years. Suppose we want to test the claim that coyotes in this region of northern Minnesota live longer than the average of 1.75 years. What is the value of the test statistic?

- a) 2.21
- b) 1.52
- c) 0.83
- d) 0.61
- e) 2.48

20) A controversy that Americans have debated in recent years is the issue of gay marriage. In a random sample of 180 American men, 90 of them claimed to have supported gay marriage. In an independent random sample of 200 American women, 150 claim to support gay marriage. Assume we are interested in the proportion of men and women who support gay marriage. Which of the following represents a pooled estimate for the proportion of all Americans who support gay marriage under the null assumption of no difference?

- a) 0.63
- b) 0.45
- c) 0.83
- d) 0.33
- e) 0.54

21) Explain what the phrase “95% confident” means when we interpret a 95% CI for  $\mu$ .

- a) 95% of the observations in the population fall within the bounds of the calculated interval.
- b) In repeated sampling, 95% of constructed intervals would contain the value of  $\mu$ .
- c) The probability that the mean falls in the calculated interval is 0.95.
- d) 95% of similarly constructed intervals would contain the value of the sampled mean.

22) Psychologists are attempting to discern if children from urban schools perform worse on state standardized tests as compared to children from rural areas. They take two random samples of school children from two schools in a large city. They then administer a 50 point standardized test to every student. The summary statistics are shown below:



<u>Urban</u>		<u>Rural</u>
38	Mean	45
2.5	Standard Deviation	3.1
15	Sample Size	18

Assume that urban students are the ‘first’ group and rural students are the ‘second’ group. You calculate a confidence interval for the difference in population means to be  $(-9.2, -5.4)$ . Which of the following is an appropriate conclusion that can be drawn from this interval?

- a) The urban students score significantly higher on these tests than the rural students, on average.
- b) The urban students score significantly lower on these tests than the rural students, on average.
- c) There is no significant difference between the scores of the students, on average.
- d) There is a significant difference between the scores of the students, but the direction of the difference cannot be determined.
- e) None of the above is a true statement.

23) An unbiased estimator of a population parameter is defined as:

- a) an estimator whose expected value is equal to the parameter.
- b) an estimator whose variance is equal to one.
- c) an estimator whose expected value is equal to zero.
- d) an estimator whose variance goes to zero as the sample size goes to infinity

24) A large study has determined that the diastolic blood pressure among women ages 18-74 is normally distributed with mean 70 mmHg and a standard deviation of  $\sigma=10$ mmHg. Suppose that you measure the diastolic blood pressure in  $n=25$  women. What is the point below which the mean diastolic blood pressures of these 25-women samples will be 5% of the time)? That is find  $x$  so that  $P(\bar{X} \leq x) = 0.05$

- a) 56.08 mmHg
- b) 66.71 mmHg
- c) 50.40 mmHg
- d) 27.55 mmHg
- e) 40.21 mmHg

25) 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)  $H_o : p < 0.98$   $H_a : p > 0.98$
- b)  $H_o : p > 0.98$   $H_a : p = 0.98$
- c)  $H_o : p = 0.98$   $H_a : p < 0.98$
- d)  $H_o : p = 0.98$   $H_a : p \neq 0.98$
- e)  $H_o : p = 0.98$   $H_a : p > 0.98$

26) Suppose that 58% of all gold dealers believe next year will be a good one to speculate in South African gold coins. In a simple random sample of 150 dealers, what is the probability that between 55% and 60% believe that it will be a good year to speculate?

- a) 0.46
- b) 0.58
- c) 0.12
- d) 0.31
- e) 0.92

The following output comes from an experiment comparing the levels of hemoglobin for a group of cigarette smokers of size  $n_1=75$  and a group of non-smokers of size  $n_2 = 121$ . Researchers want to test the claim that the mean hemoglobin level of the smokers is higher than the mean level of non-smokers.

Smokers: Number of obs = 75  
Non-smokers: Number of obs = 121

Variable	Mean	Std. Err.	t	P> t	[95% Conf. Interval]
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Ho: mean(smoker) - mean(non-smoker) = diff = 0		
Ha: diff < 0	Ha: diff ~ 0	Ha: diff > 0
t = 9.5263	t = 9.5263	t = 9.5263
P < t = 1.0000	P >  t  = 0.0000	P > t = 0.0000

a)  $H_0: \mu_1 = \mu_2$ ;  $H_a: \mu_1 \neq \mu_2$   
 b)  $H_0: \mu_1 \neq \mu_2$ ;  $H_a: \mu_1 = \mu_2$   
 c)  $H_0: \mu_1 = \mu_2$ ;  $H_a: \mu_1 > \mu_2$   
 d)  $H_0: \mu_1 = \mu_2$ ;  $H_a: \mu_1 < \mu_2$

- a) Reject  $H_0$ ; The hemoglobin levels are higher among non-smokers.
- b) Do not reject  $H_0$ ; The hemoglobin levels are equal.
- c) Do not reject  $H_0$ ; The hemoglobin levels are lower among non-smokers.
- d) Reject  $H_0$ ; The hemoglobin levels are higher among smokers.

Number of obs = 16					
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Variable	Mean	Std. Err.	t	P> t	[95% Conf. Interval]

x	232	12	19.3333	0.0000	206.4226	257.5774
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Degrees of freedom: 15

Ho: mean(x) = 211

Ha: mean < 211	Ha: mean ~ 211	Ha: mean > 211
t = 1.7500	t = 1.7500	t = 1.7500
P < t = 0.9497	P >  t  = 0.1005	P > t = 0.0503

- The  $p$  value of the test is 0.1005 and thus we fail to reject the null hypothesis and thus conclude that hypertensives have a higher cholesterol level.
- The  $p$  value of the test is 0.9497 and thus we fail to reject the null hypothesis and thus conclude that hypertensives have a lower cholesterol level.
- The  $p$  value of the test is 0.0503 and thus we fail to reject the null hypothesis and conclude that hypertension is not associated with higher cholesterol levels
- The  $p$  value of the test is 0.0503 and thus we reject the null hypothesis and conclude that the mean cholesterol level for hypertensives is higher than healthy 20-74 year-old US males

30) Suppose  $X$ ,  $Y$  and  $Z$  are independent random variables such that  $X \sim N(\mu, 1)$ ,  $Y \sim N(2\mu, 1)$  and  $Z \sim N(10\mu, 1)$ . Which of the following is an unbiased estimator of  $\mu$  from  $X$ ,  $Y$  and  $Z$ ?

- $(1/3)X + (1/3)Y + (1/3)Z$
- $(1/1)X + (1/2)Y + (1/10)Z$
- $(1/3)X + (1/6)Y + (1/30)Z$
- $(1/3)X + (2/3)Y + (10/3)Z$
- $(1/2)X + (1/2)Y$

31) Some have argued that throwing darts at the stock pages to decide which companies to invest in could be a successful stock-picking strategy. Suppose a researcher decides to test this theory and randomly chooses 150 companies to invest in. After one year, 81 of the companies were considered winners; that is, they outperformed other companies in the same investment class. To assess whether the dart-picking strategy resulted in a majority of winners, the researcher tested  $H_0: \pi=0.5$  versus  $H_a: \pi>0.5$  and obtained a P-value of 0.1636. Write a conclusion for the researcher.

- a) Because the P-value is not small, reject the null hypothesis. There is sufficient evidence to conclude that the dart-picking strategy resulted in a majority of winners.
- b) Because the P-value is small, reject the null hypothesis. There is sufficient evidence to conclude that the dart-picking strategy resulted in a majority of winners.
- c) Because the P-value is not small, do not reject the null hypothesis. There is not sufficient evidence to conclude that the dart-picking strategy resulted in a majority of winners.
- d) Because the P-value is small, do not reject the null hypothesis. There is not sufficient evidence to conclude that the dart-picking strategy resulted in a majority of winners.

32) A national organization has been working with utilities throughout the nation to find sites for large wind turbines that generate electricity. Wind speeds must average more than 13 miles per hour (mph) for a site to be acceptable. Recently, the organization conducted wind speed tests at a particular site. Based on a sample of 101 wind speed recordings (taken at random intervals), the wind speed at the site averaged 12.6 mph, with a standard deviation of 2.6 mph. To determine whether the site meets the organization's requirements, consider the test,  $H_0: \mu = 13$  vs.  $H_a: \mu > 13$ , where  $\mu$  is the true mean wind speed at the site and  $\alpha = 0.05$ . What is the conclusion of the test?

- a) There is sufficient evidence to conclude that the site meets the organization's requirements.
- b) There is not sufficient evidence to conclude that the site meets the organization's requirements.
- c) There is sufficient evidence to conclude that the average wind speed at the site exceeds 13 miles per hour.
- d) None of the above.

33) A company claims that lifetime of the lightbulb they manufacture is normally distributed with a mean of 240 hours and a standard deviation of 20 hours. An assistant at the company makes an improvement to the lightbulb and claims that the lifetime of the newer bulbs is normally distributed with a mean of 280 hours and a standard deviation of 20 hours. If we let  $X$  represent the lifetime of the lightbulb, this leads to the following null and alternative hypotheses.

- $H_0: X$  is  $N(240; 20)$
- $H_a: X$  is  $N(280; 20)$

Suppose the decision rule is that the null hypothesis will be rejected if the lifetime of the lightbulb is greater than 280 hours. Determine the probability of a Type I error.

- a) 0.067
- b) 0.023
- c) 0.084
- d) 0.075
- e) 0.097

34) In conducting a chi-square test of association between gender and grade, what is the expected count for the number of males who earned a grade of B?

	Grade			
	A	B	C	D
Male	10	32	25	2
Female	5	41	14	12

- a)  $\frac{73 * 69}{141}$
- b)  $\frac{73 * 69}{110}$
- c)  $\frac{32 * 73}{141}$
- d)  $\frac{32 * 69}{110}$
- e)  $\frac{69 * 32}{141}$

Answers:

- 1) b
- 2) a
- 3) b
- 4) b
- 5) b
- 6) b
- 7) b
- 8) a
- 9) a
- 10) c

- 11) b
- 12) b
- 13) d
- 14) d
- 15) a
- 16) c
- 17) e
- 18) d
- 19) e
- 20) a
- 21) b
- 22) b
- 23) a
- 24) b
- 25) c
- 26) a
- 27) c
- 28) d
- 29) d
- 30) c
- 31) c
- 32) b
- 33) b
- 34) a