

Stats 2035 Midterm #2 Practice Questions

- Which statement is incorrect?
 - A Type I error occurs when we reject the null hypothesis when it should not be rejected.
 - We failed to reject the null hypothesis, so it is proven that the null hypothesis is true.
 - When a false null hypothesis is not rejected, a Type II error has occurred.
 - If the null hypothesis is rejected, it is concluded that the alternative hypothesis is true.
 - The null hypothesis contains the equality sign.
- A professional basketball player is averaging 21 points per game. He will be retiring at the end of this season. The team has multiple options to replace him. However, the owner feels that signing a replacement is only justified, if he can average more than 22 points per game. Which of the following are the appropriate hypotheses for this problem?
 - $H_0: \mu \geq 22$ vs. $H_a: \mu < 22$
 - $H_0: \mu \geq 22$ vs. $H_a: \mu = 22$
 - $H_0: \mu \leq 22$ vs. $H_a: \mu > 22$
 - $H_0: \mu \geq 21$ vs. $H_a: \mu < 21$
 - $H_0: \mu \leq 21$ vs. $H_a: \mu > 21$
- In a two-sided hypothesis test, if the p value is less than α :
 - H_0 will be rejected and the result is said to be not statistically significant.
 - H_a is rejected and the result is said to be statistically significant.
 - H_0 is not rejected and the result is said to be not statistically significant.
 - H_0 is rejected and the result is said to be statistically significant.
- The average waiting time per customer at a fast food restaurant has been 7.5 minutes. The customer waiting time has a normal distribution. The manager claims that the use of a new cashier system will decrease the average customer waiting time in the store. Based on a random sample of 16 customer transactions, the mean waiting time is 6.3 minutes and the standard deviation is 2 minutes per customer. What is the value of the test statistic we would use to test H_0 ?
 - $t = -2.4$
 - $t = -1.2$
 - $t = -0.6$
 - $t = 2.4$
 - $z = -2.4$

5. For the following hypothesis test where $H_0: \mu \leq 10$ vs. $H_a: \mu > 10$, we reject H_0 at level of significance α and conclude that it appears as though the true mean is greater than 10 when the true mean is actually 8. Based on this information we can state that we have:
- A) made a Type II error
 - B) made a Type I error
 - C) made a correct decision
 - D) made an incorrect decision
 - E) both B) and D) are correct
6. A major airline company is concerned that its proportion of late arrivals has substantially increased in the past month. Historical data shows that about 18% of the company airplanes have arrived late. In a random sample of 1,240 airplanes it was found that 310 airplanes arrived late. If we are conducting a hypothesis test of a single proportion to determine if the proportion of late arrivals has increased, what is the value of the calculated test statistic?
- A) $Z = 1.833$
 - B) $Z = -6.416$
 - C) $Z = 3.208$
 - D) $Z = 6.416$
 - E) $Z = -3.208$
7. A random sample of 80 companies who announced corrections to their balance sheets took a mean time of 8.1 days for the time between balance sheet construction and the complete audit. The times were approximately Normal and the standard deviation of all such corrections was known to be 1.3 days. What is the rejection point at $\alpha = 0.001$ to test $H_0: \mu = 8$ vs. $H_a: \mu > 8$?
- A) $Z > 3.09$
 - B) $Z > 1.96$
 - C) $Z > 2.575$
 - D) $t > 3.197$
 - E) $t > 3.195$

8. The manufacturer of an over-the-counter heartburn relief medication claims that its product brings relief in less than 3.5 minutes, on average. To be able to make this claim the manufacturer was required to present statistical evidence in support of the claim. The manufacturer reported that for a sample of 50 heartburn sufferers, the mean time to relief was 3.3 minutes. The standard deviation was known to be 1.1 minutes. A p-value was calculated and H_0 was tested at $\alpha = 5\%$. Which of the following statements below is correct?
- A) p-value = 0.4015. We would reject H_0 and conclude that the result is not statistically significant.
 - B) p-value = 0.0985. We would not reject H_0 and conclude that the result is not statistically significant.
 - C) p-value = 0.005. We would reject H_0 and conclude that the result is not statistically significant.
 - D) p-value = 0.0985. We would reject H_0 and conclude that the result is not statistically significant.
 - E) p-value = 0.0129. We would reject H_0 and conclude that the result is statistically significant.
9. A psychologist has designed a new intelligence test. Historically, the time to complete the old test had an average of 120 minutes. With the altered format of the test, the psychologist claims that the time to complete the test is no longer 120 minutes, but in fact, the completion time is different now. A sample of 50 new test taking times yielded an average time of 118 minutes. The population standard deviation is known to be 5 minutes. You can assume that the completion times are approximately Normal. Calculate the appropriate p-value.
- A) 0.0046
 - B) 0.0283
 - C) 0.0566
 - D) 0.0023
 - E) -0.0283
10. Standard x-ray machines should give average radiation dosages below 5.00 milliroentgens (mil-r). To test a certain x-ray machine, a sample of 36 observations is taken with a mean of 4.13 mil-r and a standard deviation of 1.91 mil-r. Calculate the appropriate p-value and use it to test H_0 at $\alpha = 1\%$. You can assume that the radiation doses are approximately Normal.
- A) p-value = 0.0032. We would not reject H_0 .
 - B) p-value < 0.005. We would reject H_0 .
 - C) p-value < 0.001. We would reject H_0 .
 - D) p-value > 0.01. We would not reject H_0 .
 - E) p-value > 0.05. We would not reject H_0 .

11. A 95% confidence interval for the mean difference time taken to process new insurance policies at two companies is (11, 12) days. How should this interval be interpreted?
- A) Only 5 percent of all policies take less than 11 or more than 12 days to process
 - B) Only 5 percent of all policies take between 11 and 12 days to process
 - C) About 95 out of every 100 such intervals constructed from random samples of the same size will contain the sample mean difference processing time
 - D) The probability is 0.95 that all policies take between 11 and 12 days to process by the two companies
 - E) The mean difference processing time of all insurance policies for two companies is unknown, but we can be 95% confident that it is between 11 and 12 days.
12. A very simple interval estimator for $\mu_1 - \mu_2$ is $(\bar{x}_1 - \bar{x}_2) \pm 1.96 \sigma_{\bar{x}_1 - \bar{x}_2}$. Which of the following statements is/are true if sample sizes, n_1 and n_2 , are “large”?
- A) This interval will contain the true value of $\mu_1 - \mu_2$ approximately 95 times out of one hundred.
 - B) This interval is an approximate 95% confidence interval for $\mu_1 - \mu_2$
 - C) This interval is too narrow to be a useful interval estimator for μ .
 - D) This interval will contain the true value of $\mu_1 - \mu_2$ 997 times out of 1000.
 - E) Both (A) and (B) are true.
13. Auditor A is faced with a population of 1,000 accounts (Population A). He is going to select a random sample of 30 accounts from Population A and use the average amount owing in these sampled accounts as an estimate of the average amount owing in Population A using a confidence interval. Auditor B is faced with a population of 10,000 accounts (Population B). He is going to select a random sample of 30 accounts from Population B and use the average amount owing in these sampled accounts as an estimate of the average amount owing in Population B using a confidence interval. Other factors (confidence level, variability of amounts owing in the populations, etc.) being equal:
- A) Auditor A’s estimate will be about 10 times more accurate than Auditor B’s estimate.
 - B) Auditor B’s estimate will be about 10 times more accurate than Auditor A’s estimate.
 - C) Auditor A’s estimate will be about 3.16 times more accurate than Auditor B’s estimate.
 - D) Auditor B’s estimate will be about 3.16 times more accurate than Auditor A’s estimate.
 - E) the accuracy of the two estimates will be about the same.

14. Which of the following can always be said about the relationship between the test statistic value (Z) and the p-value in a test of $H_0 : \mu_1 - \mu_2 = D_0$ versus $H_a : \mu_1 - \mu_2 \neq D_0$?
- A) The smaller the value of Z , the larger the p-value.
 - B) The larger the value of Z , the larger the p-value.
 - C) The smaller the value of $|Z|$, the larger the p-value.
 - D) The larger the value of $|Z|$, the larger the p-value.

15. A firm producing plate glass has developed a less expensive tempering process to allow glass for fireplaces to rise to a higher temperature without breaking. To test it, five different plates of glass were drawn randomly from a production run, then cut in half, with one-half tempered by the new process, and the other half by the old. The two halves were then heated until they broke, yielding the following summary data from the two samples:

	<u>Mean</u>	Standard Deviation (<u>S</u>)	<u>n</u>
New	463	30.3	5
Old	467	29.0	5
Difference	-4	4.64	5

Assuming temperature differences are approximately normally distributed, a 95% confidence interval for the population mean improvement (mean of the new – mean of the old) in breaking temperature is

- A) -4 ± 5.76
 - B) -4 ± 43.2
 - C) -4 ± 8.33
 - D) -4 ± 11.9
 - E) -4 ± 4.07
16. A research group wished to estimate time spent by male students and female students on sports activities during last semester. They randomly selected 50 male students and found that these students had spent average of 7.89 days with a standard deviation of 3.67 days on such activities. They also randomly selected 32 female students and found that these female students had spent average of 5.99 days with a standard deviation of 3.65 days. Since sample standard deviations are very close in value, population standard deviations for the males and females can also be assumed to be equal. A 99% confidence interval for the difference between the mean time spent by all male students and mean time spent by all female students on sports activities is
- A) (-0.23, 4.03)
 - B) (-0.03, 3.83)
 - C) (-0.29, 4.09)
 - D) (0.29, 4.09)

17. Refer to the previous question (Question 16).

Based on the reasoning of hypothesis tests, using $\alpha = 0.01$ and a two-sided test, which of the following statements is TRUE?

- A) There is enough evidence to conclude that the average time spent by male and female students on sports activities differs by 3 days.
- B) The length of the confidence interval constructed is 2.19.
- C) There is 0.99 probability that the true average time difference in male and female sports activities is 1.9 days.
- D) There is not enough evidence to conclude that the average time spent by male and female students on sports activities differs by 3 days.

18. The following are percentages of fat found in 5 samples of each of two brands of ice cream:

Brand A:	6.1	5.4	6.2	6.3	5.4
Brand B:	6.3	5.7	5.9	6.4	5.1

Sample standard deviations for brands A and B are 0.444 and 0.522 respectively. Which of the following procedures is appropriate to test the hypothesis of equal average fat content in the two types of ice cream?

- A) Paired t-test with 5 d.f.
- B) Two sample t-test with 8 d.f.
- C) Paired t-test with 4 d.f.
- D) Two sample z-test
- E) Two sample t-test with 9 d.f.

19. A left-tailed z test to test $H_0 : \mu_1 - \mu_2 = 0$ is conducted with $\alpha = 0.07$. Determine the critical value(s).

- A) -0.07
- B) 0.14
- C) -1.48
- D) -1.48 and 1.48
- E) 0.07 and 0.93

20. Two surgical procedures are widely used to treat a certain type of cancer. To compare the success rates of the two procedures, a random sample from each type of procedure is obtained, and the number of patients with no reoccurrence of the disease after 1 year was recorded. Here is the data.

	<u>n</u>	<u>Number of patients with no reoccurrence</u>
Procedure A	100	78
Procedure B	120	102

A 95% confidence interval for the difference in success rates of procedure B and Procedure A is:

- A) 0.07 ± 0.053
 - B) 0.07 ± 0.0054
 - C) 0.07 ± 0.103
 - D) 0.07 ± 0.115
 - E) 0.07 ± 0.059
21. Random samples of 50 women and 50 men are taken at the University of Manitoba. They are asked their reaction to increased tuition fees. The results are as follows:

Men in favour: 18

Women in favour: 22

It is suspected that a larger proportion of women favour such increases. Based on the data (with $\alpha = .05$):

- A) Our suspicions are confirmed as the p-value is 0.2061.
 - B) Our suspicions are confirmed as the p-value is 0.2939.
 - C) Our suspicions are confirmed as the p-value is 0.82.
 - D) We cannot conclude that a larger proportion of women are in support of the increase as the p-value is 0.2061.
 - E) We cannot conclude that a larger proportion of women are in support of the increase as the p-value is 0.2939.
22. The t distribution approaches the _____ as the sample size _____.
- A) Binomial; increases
 - B) Binomial; decreases
 - C) Z distribution; decreases
 - D) Z distribution; increases
 - E) Both (A) and (C) are correct

23. The width of a confidence interval for a single population mean will be
- A) Narrower for 99% confidence than 95% confidence.
 - B) Wider for a sample size of 100 than for a sample size of 50.
 - C) Narrower for 90% confidence than 95% confidence.
 - D) Wider when the sample standard deviation (s) is small than when s is large.
 - E) Both (A) and (B) are correct
24. A Research and Development Laboratory researcher for a paint company is measuring the level of a certain chemical contained in a certain type of paint. If the paint contains too much of this chemical, the quality of the paint will be compromised. How many cans of paint should the sample contain if the researcher wants to be 95% certain of being within 1% of the true proportion of this chemical?
- A) 9,604
 - B) 10,201
 - C) 1,273
 - D) 1,359
 - E) None of the above
25. When the level of confidence and variance remain the same, a confidence interval for a population mean, μ based on a sample of $n = 100$ will be _____ as the confidence interval for μ based on a sample of $n = 400$.
- A) twice as wide B) half as wide C) the same size D) four times as wide
26. In a manufacturing process a random sample of 9 bolts manufactured has a mean length of 3 cm with a sample variance of 0.09. Suppose that the length of the bolt approximately follows a normal distribution. What is the 90% confidence interval for the true mean length of the bolt?
- A) 2.8355 to 3.1645
 - B) 2.5065 to 3.4935
 - C) 2.4420 to 3.5580
 - D) 2.8140 to 3.1860
 - E) 2.9442 to 3.0558
27. A random sample of 1,500 observations gave the 95% confidence interval, $\mu = 810 \pm 62$. What would the margin error be, if we wanted just 90% confidence? (Assume that σ is known).
- A) ± 65 B) ± 59 C) ± 74 D) ± 52 E) Cannot be determined

28. The internal auditing staff of a local manufacturing company performs a sample audit each quarter to estimate the proportion of accounts that are delinquent (more than 90 days overdue). For this quarter, the auditing staff randomly selected 400 customer accounts and found that 80 of these accounts were delinquent. What is the 95% confidence interval for the proportion of all delinquent customer accounts at this manufacturing company?

- A) 0.1608 to 0.2392
- B) 0.1992 to 0.2008
- C) 0.1671 to 0.2329
- D) 0.1485 to 0.2515
- E) 0.1714 to 0.2286

29. A random sample of 150 observations gave the following totals:

$$\sum X_i = 55.5 \quad \text{and} \quad \sum (X_i - \bar{X})^2 = 618.$$

The 95% confidence interval for the population mean is therefore

- A) $0.37 \pm 1.96 \sqrt{0.37(1-0.37)/150}$
 - B) $0.37 \pm 1.96 \sqrt{(618/149)/150}$
 - C) $0.37 \pm 1.96 \sqrt{618/150}$
 - D) $0.37 \pm 1.96 \sqrt{618/149}$
30. A coin was flipped 600 times in order to test if it was fair or not and the following 95% confidence interval was constructed: $52\% \pm 4\%$. Is there evidence to suggest that the observed result is statistically significant, at the 5% error level?
- A) Yes, because the null hypothesis value is inside the confidence interval.
 - B) Yes, because the null hypothesis value is outside of the confidence interval
 - C) No, because the null hypothesis value is inside the confidence interval.
 - D) No, because the null hypothesis value is outside of the confidence interval.