STA 100 Quiz 2

Instructions:

- Select the best answer for each question.
- Use only #2 pencil.
- You must print your name and fill student ID number (nine digits).
- Mark **B** in Test Form field.
- Completely fill in each circle.
- Do not fold the answer sheet.
- Do not make random marks anywhere on exam sheet.
- If you are erasing a mistake, then completely remove all pencil marks from the incorrect answer. Do not put X through it.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
(d)	(a)	(c)	(a)	(b)	(b)	(c)	(b)	(c)	(c)	(b)	(d)	(c)	(a)	(b)	(d)	(a)	(c)	(d)	(b)

1. Which of the following statements is correct regarding the Central Limit Theorem (CLT)?
   (a) CLT is applied regardless of the sample size n.
   (b) CLT guarantees that the population mean is normally distributed when n is sufficiently large.
   (c) CLT states that the sample mean $\bar{Y}$ is always normal if the population distribution is normal.
   (d) CLT states that the sampling distribution of $\bar{Y}$ is approximately normal if n is large.
2. 16 observations was randomly sampled from an unknown distribution with mean 100 and variance 64. Which of the following statements is the most appropriate regarding the sampling distribution of the sample mean $\bar{Y}$?
   (a) $\mu_{\bar{Y}} = 100, \sigma_{\bar{Y}} = 2$.
   (b) $\mu_{\bar{Y}} = 100, \sigma_{\bar{Y}} = 0.5$.
   (c) $\bar{Y} \sim N(100, 4)$.
   (d) $\bar{Y} \sim N(100, 0.25)$.
3. Suppose that a fair coin is tossed 100 times. Approximate the probability that the number of heads is equal to 51.
   (a) 0.
   (b) 0.4201.
   (c) 0.0781.

(d) 0.3821.

4. Which of the following statements is true?

   (a) A type I error is committed by rejecting the null hypothesis when it is true.

   (b) A 95% confidence interval for μ is $(31.4, 34.2)$. It follows that $P(31.4 < \mu < 34.2) = 0.95$.

   (c) If we incorrectly use the normal distribution rather than the student's t distribution, then we are less likely to reject the null hypothesis.

   (d) For the hypothesis $H_0 : \mu_1 - \mu_2 = 0$ as the sample size increases, the absolute value of the test statistic decreases.

5. To help consumers assess the risks they are taking, the Food and Drug Administration (FDA) publishes the amount of nicotine found in all commercial brands of cigarettes. A new cigarette has recently been marketed. The FDA tests on this cigarette yielded mean nicotine content of 26.5 milligrams and standard deviation of 2.7 milligrams for a sample of $n = 9$ cigarettes. Construct a 90% confidence interval for the mean nicotine content of this brand of cigarette. You may assume the population is normal.

   (a) $(25.243, 27.757)$.

   (b) $(24.826, 28.174)$.

   (c) $(24.724, 28.276)$.

   (d) $(25.166, 27.834)$.

6. Continue with Question 5, how many cigarettes should we sample to estimate the mean nicotine content to within 1 milligrams at the 95% level of significance? Assume the t multiplier equals 2.

   (a) $n = 29$.

   (b) $n = 30$.

   (c) $n = 31$.

   (d) $n = 32$.

*Questions **7–11** refer to the following situation.*

Kaito grows tomatoes in two separate fields. He takes a random sample of plants from each field and measures the heights of the plants. Here is a summary of the results:

	Field 1	Field 2
Mean	1.3 m	1.6 m
Standard deviation	0.5 m	0.3 m
Number of plants	12	14

Kaito wants to use this sample to test whether the mean height of the tomato plant in Field 1 (μ_1) is less than Filed 2 (μ_2). Assume that the height of the tomato plant is normally distributed and the degrees of freedom $\nu = 20$.

7. State the null and alternative hypotheses.

   (a) $H_0 : \mu_1 = 0$ v.s. $H_A : \mu_1 \neq 0$.

   (b) $H_0 : \mu_1 - \mu_2 = 0$ v.s. $H_A : \mu_1 - \mu_2 \neq 0$.

   (c) $H_0 : \mu_1 - \mu_2 \geq 0$ v.s. $H_A : \mu_1 - \mu_2 < 0$.

   (d) $H_0 : \mu_1 - \mu_2 \leq 0$ v.s. $H_A : \mu_1 - \mu_2 > 0$.

8. Find the test statistic.

   (a) $T = 1.82$.

(b) $T = -1.82$.

(c) $T = 2.70$.

(d) $T = -2.70$.

9. Find the range of the p-value.

   (a) $(0.01, 0.02)$.

   (b) $(0.02, 0.04)$.

   (c) $(0.04, 0.05)$.

   (d) $(0.08, 0.10)$.

10. Find the critical value for level of significance $\alpha = 0.01$.

    (a) -2.681.

    (b) -3.055.

    (c) -2.528.

    (d) -2.845.

11. Calculate the upper one-sided 95% confidence interval for $\mu_1 - \mu_2$.

    (a) $(-\infty, 0.044)$.

    (b) $(-\infty, -0.015)$.

    (c) $(-\infty, -0.070)$.

    (d) $(-\infty, -0.102)$.

*Questions **12–16** refer to the following situation.*

A biologist is interested in investigating the effectiveness of a new drug on blood pressure. The biologist collects data from 10 individuals by measuring their blood pressure before and after taking the drug. The data are as follows:

	Blood pressure
Before	130, 125, 135, 140, 128, 132, 130, 138, 133, 135
After	125, 120, 130, 137, 123, 128, 126, 135, 130, 132

The biologist wants to test whether there is a significant difference in the mean blood pressure before (μ_1) and after (μ_2) taking the drug. Assume the blood pressure is normally distributed.

12. State the null and alternative hypotheses.

    (a) $H_0 : \mu_2 = 0$ v.s. $H_A : \mu_2 \neq 0$.

    (b) $H_0 : \mu_1 - \mu_2 \geq 0$ v.s. $H_A : \mu_1 - \mu_2 < 0$.

    (c) $H_0 : \mu_1 - \mu_2 \leq 0$ v.s. $H_A : \mu_1 - \mu_2 > 0$.

    (d) $H_0 : \mu_1 - \mu_2 = 0$ v.s. $H_A : \mu_1 - \mu_2 \neq 0$.

13. Find the test statistic.

    (a) $T = 12.728$.

    (b) $T = 1.905$.

    (c) $T = 13.416$.

    (d) $T = 1.807$.

14. Find the range of p-value.

(a) $(0, 0.001)$.
(b) $(0.005, 0.01)$.
(c) $(0.02, 0.025)$.
(d) $(0.04, 0.05)$.

15. Find the critical value for level of significance $\alpha = 0.05$.

(a) 1.833.
(b) 2.262.
(c) 1.734.
(d) 2.101.

16. Calculate the 99% confidence interval for $\mu_1 - \mu_2$.

(a) $(-1.660, 9.660)$.
(b) $(-2.386, 10.386)$.
(c) $(3.159, 4.841)$.
(d) $(3.031, 4.969)$.

17. Which sample size would yield the most narrow confidence interval for an unknown proportion, all other things being equal?

(a) $n = 500$.
(b) $n = 188$.
(c) $n = 50$.
(d) $n = 17$.

18. A study finds that 38 out of 96 seals sampled from an ecosystem are earless. Which of the following gives a 95% confidence interval for the proportion of seals that are earless?

(a) $(0.399, 0.601)$.
(b) $(0.402, 0.598)$.
(c) $(0.304, 0.496)$.
(d) We don't need a confidence interval, because the proportion of earless seals is clearly just 48/96.

19. A chi-square goodness-of-fit test results in a test statistic value of 20. If the test is evaluating a claim about a population with 8 categories, which of the following is closest to the resulting p-value?

(a) 0.2.
(b) 0.1.
(c) 0.05.
(d) 0.01.

20. Mongolian gerbils are thought to be equally likely to be brown, white, or black in color. A random sample showed the following frequencies:

	Black	Brown	White
Count	40	30	50

Calculate the test statistic for the chi-square goodness-of-fit test.

(a) $T = 5.33$.
(b) $T = 5$.
(c) $T = 0$.
(d) $T = 0.5$.