

CUET Mathematics Test

Chapter: Unit VI: Inferential Statistics (Intermediate Level)

General Instructions

1. Total Questions: **15**
2. Duration: **60 Minutes**
3. All questions are compulsory.
4. Each question carries **5 marks**.
5. For each correct answer: **+5 marks**.
6. For each incorrect answer: **-1 mark**.
7. No negative marking for unanswered questions.
8. Use of calculator or electronic devices is strictly prohibited.
9. Choose the most appropriate answer from the given options.

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1. A statistician takes a sample of size n from a population with mean μ and variance σ^2 . The variance of the sampling distribution of the sample mean is:
 - (A) σ^2
 - (B) σ/\sqrt{n}
 - (C) σ^2/n
 - (D) σ^2/\sqrt{n}
2. The probability of committing a Type I error is denoted by:
 - (A) α
 - (B) β
 - (C) $1 - \alpha$
 - (D) $1 - \beta$
3. For a t-distribution with k degrees of freedom, the variance is given by:
 - (A) 1
 - (B) $k/(k - 2)$ for $k > 2$
 - (C) $(k - 1)/k$
 - (D) k^2
4. If the null hypothesis $H_0 : \mu = 100$ is rejected at the 5% level of significance, then:
 - (A) It must also be rejected at the 1% level.
 - (B) It may or may not be rejected at the 1% level.
 - (C) It must be accepted at the 10% level.
 - (D) The sample mean is exactly 100.
5. In a two-sample t-test for independent samples with $n_1 = 8$ and $n_2 = 8$, and equal population variances, the critical value should be checked at how many degrees of freedom?
 - (A) 16
 - (B) 15
 - (C) 14
 - (D) 7
6. Which of the following conditions is NOT an assumption for the application of a t-test?
 - (A) The population from which the sample is drawn is normal.
 - (B) The sample observations are independent.
 - (C) The sample size must be greater than 30.
 - (D) The population standard deviation is unknown.
7. The power of a statistical test is defined as:
 - (A) $P(\text{Reject } H_0 \text{ when } H_0 \text{ is true})$
 - (B) $P(\text{Accept } H_0 \text{ when } H_0 \text{ is false})$
 - (C) $P(\text{Reject } H_0 \text{ when } H_0 \text{ is false})$
 - (D) $P(\text{Accept } H_0 \text{ when } H_0 \text{ is true})$
8. If the standard error of the mean is 2 for a sample size of 16, the population standard deviation is:
 - (A) 8
 - (B) 32
 - (C) 4
 - (D) 16
9. A t-test is used to compare the means of two groups. If the calculated p-value is 0.03, and the significance level is 0.05, the conclusion is:
 - (A) Fail to reject the null hypothesis.

- (B) Reject the null hypothesis.
 (C) The test is invalid.
 (D) The population means are identical.
10. The Central Limit Theorem is applicable to which type of population?
 (A) Only Normal populations
 (B) Only Discrete populations
 (C) Only Continuous populations
 (D) Any population with a finite variance
11. In a one-sample t-test, the sample mean is 25, the hypothesized mean is 20, and the standard error is 2. The value of the t-statistic is:
 (A) 2.5
 (B) 5.0
 (C) 10.0
 (D) 1.25
12. The relationship between the standard normal distribution (Z) and the t-distribution is such that:
 (A) The t-distribution has thicker tails than the Z distribution.
 (B) The Z distribution has thicker tails than the t-distribution.
 (C) They are identical for all sample sizes.
 (D) The t-distribution is skewed, while Z is symmetric.
13. For two independent samples, the pooled sample variance s_p^2 is a weighted average of the two sample variances, where the weights are:
 (A) n_1 and n_2
 (B) $n_1 - 1$ and $n_2 - 1$
 (C) $\sqrt{n_1}$ and $\sqrt{n_2}$
 (D) $1/n_1$ and $1/n_2$
14. If we increase the sample size n while keeping the confidence level constant, the width of the confidence interval for the mean:
 (A) Increases
 (B) Decreases
 (C) Remains the same
 (D) Becomes zero
15. A paired t-test is used when:
 (A) The two samples are independent.
 (B) The observations in one sample are linked to observations in the other.
 (C) The variances are unequal.
 (D) The population is not normal.

Solutions

- Solution:** Standard Error is σ/\sqrt{n} , so the variance of the sampling distribution is the square of SE, which is σ^2/n . **Correct Option: (C)**
- Solution:** Type I error (rejecting a true null hypothesis) is represented by α (significance level). **Correct Option: (A)**
- Solution:** The variance of the t-distribution is $k/(k - 2)$ for $df > 2$. Note that it is always greater than 1, reflecting heavier tails than Z . **Correct Option: (B)**

4. **Solution:** If you reject at 5%, the p-value is < 0.05 . It might be 0.03 (not rejected at 1%) or 0.005 (rejected at 1%). Thus, it may or may not be rejected at 1%. **Correct Option: (B)**
5. **Solution:** $df = n_1 + n_2 - 2 = 8 + 8 - 2 = 14$. **Correct Option: (C)**
6. **Solution:** The t-test is specifically used when $n < 30$. Small sample size is an application requirement, not a restriction that it "must" be large. **Correct Option: (C)**
7. **Solution:** Power is $1 - \beta$, which is the probability of correctly rejecting a false null hypothesis. **Correct Option: (C)**
8. **Solution:** $SE = \sigma/\sqrt{n} \implies 2 = \sigma/\sqrt{16} \implies 2 = \sigma/4 \implies \sigma = 8$. **Correct Option: (A)**
9. **Solution:** If $p\text{-value} \leq \alpha$, we reject H_0 . Since $0.03 < 0.05$, we reject the null hypothesis. **Correct Option: (B)**
10. **Solution:** CLT is a powerful theorem that applies to almost any population distribution, provided it has a finite mean and variance. **Correct Option: (D)**
11. **Solution:** $t = (\bar{x} - \mu)/SE = (25 - 20)/2 = 5/2 = 2.5$. **Correct Option: (A)**
12. **Solution:** The t-distribution is more spread out (shorter peak, thicker tails) to account for the uncertainty of estimating σ with s . **Correct Option: (A)**
13. **Solution:** $s_p^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$. The weights are the degrees of freedom of each sample. **Correct Option: (B)**
14. **Solution:** Width $\propto 1/\sqrt{n}$. As n increases, SE decreases, making the interval narrower (more precise). **Correct Option: (B)**
15. **Solution:** Paired t-tests are for "Before and After" studies or matched pairs where the samples are dependent. **Correct Option: (B)**

SOLUTIONS

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