MCQs SET 1 MTH302 (U5 and U6)

1. Criteria to check a point estimator to be good are

Degrees of Freedom

The t-ratio

Standard Error of the Means

All of the Above

2. A quantity obtained by applying a certain rule or formula is known as

Sample

Test Statistics

Estimate

Estimator

3. Consistency of an estimator can be checked by comparing

Mean

Mean Square

Variance

Standard Deviation

4. If Var(T2)<Var(T1), then T2 is

Unbiased

Efficient

Sufficient

Consistent

9. If $f(x_1,x_2,\cdots,x_n;\theta)=g(\hat{\theta};\theta)h(x_1,x_2,\cdots,xn;\theta)$, then $\hat{\theta}$ is

Unbiased

Efficient

Sufficient

Consistent

10. If Var($\hat{\theta}$)→0 as n→0, then $\hat{\theta}$ is said to be

Unbiased

Sufficient

Efficient

Consistent

11. If T=t(X1,X2,⋯,Xn) is an unbiased estimator of τ(θ), then below inequality is called

$$Var_\theta(T) \geq \frac{[\tau'(\theta)]^2}{nE[\frac{\partial}{\partial\theta} log f((X;\theta)^2]}$$

Cauchy Schwarz Inequality

Bool’s Inequality

Chebyshev’s Inequality

Cramer Rao Inequality

13. If E($\hat{\theta}$)=θ, then $\hat{\theta}$ is said to be

Unbiased

Sufficient

Efficient

Consistent

15. If the conditional distribution of $X_1,X_2,\cdots,X_n$ given S=s, does not depend on θ, for any value of S=s, the statistics $S=s(X_1,X_2,\cdots,X_n)$ is called

Unbiased

Consistent

Sufficient

Efficient

16. If X1,X2,⋯,Xn is the joint density of n random variables, say, f(X1,X2,⋯,Xn;θ) which is considered to be a function of θ. Then L(θ; X1,X2,⋯,Xn) is called

Maximum Likelihood function

Likelihood Function

Log Function

Marginal Function

24. Parameters are those constants which occur in:

Samples

Probability Density Functions

A Formula

None of these

27. The formula used to estimate a parameter is called

Estimate

Estimation

Estimator

Confidence Interval

28. In point estimation we get

More than one value

A single value

Some arbitrary interval values

None of these

29. The probability that the confidence interval does not contain the population parameter is denoted by

α

β

1−α

1−β

31. A statistic θ^ is said to be an unbiased estimator of θ, if

$E(\hat{\theta}) \neq \theta$

$E(\hat{\theta}) > \theta$

$\mathbf{E(\hat{\theta}) = \theta}$

$E(\hat{\theta}) < \theta$

32. A specific value calculated from sample is called

Estimator

Estimate

Estimation

Bias

33. The way of finding the unknown value of population parameter from the sample values by using a formula is called

Estimator

Estimation

Estimate

Bias

34. The following is an unbiased estimator of the population variance σ^2

$$S^2 = \frac{(\sum X - \overline{X})^2}{n}$$

$$S^2 = \frac{(\sum X - \overline{X})^2}{n-1}$$

$$S = \sqrt{\frac{(\sum X - \overline{X})^2}{n}}$$

$$S = \sqrt{\frac{(\sum X - \overline{X})^2}{n-1}}$$

Second one is the answer.

35. A function that is used to estimate a parameter is called

Bias

Estimate

Estimation

Estimator

Answers of the following mcqs are given in the end

- **Multiple Choice Questions**

1. The process of using sample data to estimate the values of unknown population parameters is called
   (a) estimation (b) population
   (c) sampling (d) interval estimation

2. The process of making estimates about the population parameter from a sample is called statistical
   (a) decision (b) inference
   (c) hypothesis (d) independence

3. A member of the population is called
   (a) data (b) element
   (c) family (d) group

4. Random sampling is useful as it is
   (a) reasonably more accurate as compared to other methods
   (b) economical in nature
   (c) free from personal biases of the investigator
   (d) All of the above

5. A statement made about a population for testing purpose is called

(a) testing statistics (b) level of significance
(c) statistics (d) hypothesis

6. If the null hypothesis is false, then which of the following is accepted?

(a) Alternate hypothesis (b) Null hypothesis
(c) Negative hypothesis (d) Positive hypothesis

7. Population value is called

(a) variable (b) parameters
(c) data (d) statistics

8. Sampling which provides for a known non-zero equal chance of selection is

(a) probability sampling (b) non-probability sampling
(c) snowball sampling (d) convenience sampling

9. A hypothesis which defines the population distribution is called

(a) statistical hypothesis (b) null hypothesis
(c) composite hypothesis (d) simple hypothesis

10. The probability of Type I error is referred as

(a) β (b) $1 - \alpha$
(c) α (d) $1 - \beta$

11. The point estimate of the population mean from a simple random sample 3, 6, 8, 10, 12, 15 is

(a) 6 (b) 9
(c) 4 (d) 12

12. In a statistical hypothesis test, then hypothesis is true but our test rejects it, it is

(a) Type II error (b) Type I error

(c) Both Type I and II error (d) None of these

13. If 700 throws of six-faced die, odd points appeared 400 times, the die is fair at 6% level of significance, then hypothesis is

(a) rejected (b) accept

(c) error (d) None of these

14. Consider the following hypothesis test

$$H_0 : \mu \leq 20$$
$$H_a : \mu > 20$$

A sample of 40 provided a sample mean of 24.3 and population standard deviation is 5. The value of the test statistics is

(a) 4.24 (b) 5.63

(c) 6.84 (d) 2.36

15. If a coin is tossed 20 times and the coin falls on head after any toss, it is success. Suppose the probability of success is 0.5, the probability that the number of success is less than or equal to 12 is

(a) 0.542 (b) 0.749

(c) 0.8133 (d) 0.6431

16. A 95% confidence interval for a population was reported to be 152 to 162. If $\sigma = 15$, then sample size is

(a) 60 (b) 54 (c) 72 (d) 65

17. If the critical region is evenly distributed, then the test is referred as?

(a) Zero tailed (b) One tailed

(c) Two tailed (d) Three tailed

18. The assumed hypothesis which is tested for rejection considering it to be true is called

(a) true hypothesis (b) alternative hypothesis
(c) null hypothesis (d) simple hypothesis

19. Consider the following hypothesis test

$$H_0 : \mu \geq 45$$
$$H_a : \mu < 45$$

A sample of 36 provided a sample mean, $\bar{x} = 44$ and a sample standard deviation, $S = 5.2$. If $\alpha = 0.01$, then

(a) do not reject H_0 (b) reject H_0
(c) $t = 4.82$ (d) $t = 9.2$

20. Consider the following hypothesis test

$$H_0 : p \geq 0.84$$
$$H_a : p < 0.84$$

A sample of 400 provided a sample proportion of 0.75, then the value of the test statistics

(a) – 4.86 (b) – 2.51 (c) – 6.90 (d) – 5.42

SOLUTIONS

1. (*a*) Clearly, to estimate the values of unknown population parameters by using sample data is called estimation.
2. (*b*) The process through which inference about the population are drawn which is based on population parameter is called statistical inference.
3. (*b*) A member of the population is called element.
4. (*d*) All the given options are correct.
5. (*d*) Hypothesis is a statement made about a population, it is tested and corresponding accepted, if true and rejected, if false.

6. (*a*) If the null hypothesis is false, then alternative hypothesis is accepted, it is also called as research hypothesis.

7. (*b*) The values (measurable characteristics) obtained from the study of population such as the population mean (μ), population variance (σ^2), population standard deviation (σ) and etc. are called parameters.

8. (*a*) When selection of objects from the population is random, so objects of the population has an equal.

9. (*d*) A hypothesis which defines the population distribution is called as simple hypothesis. It specifies all parameter values.

10. (*b*) We know that, testing of hypothesis Type 1 error occurs when we reject H_0, if it is true.

    Since, the probability of H_0 is α.

    $\therefore$ Error probability will be $1 - \alpha$.

11. (*b*) Given, sample data is 3, 6, 8, 10, 12, 15

    $\therefore$ The point estimate of population mean is sample mean.

    $$\therefore \bar{x} = \frac{\Sigma x_i}{n} = \frac{3 + 6 + 8 + 10 + 12 + 15}{6} = \frac{54}{6} = 9$$

12. (*b*) In a statistical hypothesis test, when the hypothesis is true but our test rejects it, is called Type I error.

13. (*a*) Let us take the hypothesis that the die is not biased

$$\therefore p = \frac{1}{2}, q = \frac{1}{2}, n = 700 \text{ and } np = 700 \times \frac{1}{2} = 350$$

then, $$Z = \frac{x - np}{\sqrt{npq}}$$

$$= \frac{400 - 350}{\sqrt{700 \times \frac{1}{2} \times \frac{1}{2}}} = \frac{50}{\sqrt{175}} = 3.78$$

Since, the computed value of z is greater than the table value (1.96 at 5% level of significance, the hypothesis is rejected).

14. (*a*) We have, $\mu_0 = 20, n = 40, \bar{x} = 24.3$ and $\sigma = 5$

$$\therefore \text{Test statistics, } Z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

$$= \frac{24.3 - 20}{5 / \sqrt{24.3}} = \frac{4.3 \times \sqrt{24.3}}{5} = 4.24$$

15. (*c*) Given, $\mu = np = 20 \times 0.5 = 10$

$$\sigma = \sqrt{npq} = \sqrt{20 \times 0.5 \times 0.5}$$

$$= \sqrt{5} = 2.24$$

$$\text{Now, } Z = \frac{x - \mu}{\sigma} = \frac{x - np}{\sqrt{npq}}$$

$$= \frac{12 - 10}{2.24} = \frac{2}{2.24} = 0.89$$

$$\therefore P(Z < 0.89) = F(0.89) = 0.8133$$

16. (*b*) Let the sample mean be $\bar{x}$ and margin of error be E.

Then, $$\bar{x} - E = 152 \quad \ldots(\text{i})$$
and $$\bar{x} + E = 160 \quad \ldots(\text{ii})$$

On solving Eqs. (i) and (ii), we get
$$E = 4$$
Given, $1 - \alpha = 95\% = 0.95$
$$\Rightarrow \quad \alpha = 0.05$$
$$\therefore \quad Z_{\alpha/2} = Z_{0.025} = 1.96$$

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Margin of error $= Z_{\alpha/2} \cdot \dfrac{\sigma}{\sqrt{n}}$

$$\Rightarrow \quad 4 = 1.96 \times \frac{15}{\sqrt{n}}$$
$$\Rightarrow \quad \sqrt{n} = \frac{1.96 \times 15}{4} = 7.35$$
$$\Rightarrow \quad n = (7.35)^2 = 54.0225 \Rightarrow n = 54$$

17. (*c*) In two-tailed test the critical region is evenly distributed. One region contains the area where null hypothesis is accepted and another contains the area where it is rejected.

18. (*c*) Null hypothesis asserts that there is no true difference in sample statistics and population parameter under consideration.

19. (*a*) Given, $n = 36, \bar{x} = 44, S = 5.2$ and $\mu_0 = 45$,

$$\therefore \qquad t = \frac{\bar{x} - \mu_0}{S/\sqrt{n}} = \frac{44 - 45}{5.2/\sqrt{36}}$$

$$= \frac{-1 \times 6}{5.2} = -1.15 < 0$$

and degree of freedom = $36 - 1 = 35$

$\therefore p$-value = 2 (Area under the standard normal curve to the left of Z)

= $2 \times$ Area under the t-distribution curve to the right of t.

From the t-distribution table, we find the $t = 1.15$ lies between 1.306 and 1.690 for which area lies between 0.05 and 0.10.

So, p-value lies between 2×0.05 and 2×0.10 i.e. between 0.10 and 0.20.

So, $0.10 < p\text{-value} < 0.20$

Since, p-value > 0.01

So, we do not reject H_0.