QB365 Question Bank Software Study Materials

Sampling Techniques and Statistical Inference Important 2,3 & 5 Marks Questions With Answers (Book Back and Creative)

12th Standard

Business Maths and Statistics

Total Marks : 50

2 Marks

10 x 2 = 20

1) A server channel monitored for an hour was found to have an estimated mean of 20 transactions transmitted per minute. The variance is known to be 4. Find the standard error.

Answer : Givens σ^2 = 4 which implies σ = 2, n = 1 hour = 60 min, $\bar{X}$ = 20/min
Standard Error $= \frac{\sigma}{\sqrt{n}} = \frac{2}{\sqrt{60}} = 0.2582$

2) A sample of 100 students is chosen from a large group of students. The average height of these students is 162 cm and standard deviation (S.D) is 8 cm. Obtain the standard error for the average height of large group of students of 160 cm?

Answer : Give n = 100, $\bar{x}$ =162 cm, s = 8 cm is known in this problem
since σ is unknown , so we consider $\hat{\sigma}$ = s and φ = 160 cm
$S.E = \frac{\hat{\sigma}}{\sqrt{n}} = \frac{s}{\sqrt{n}} = \frac{8}{\sqrt{100}} = 0.8$
Therefore the standard error for the average height of large group of students of 160 cm is 0.8.

3) What is standard error?

Answer : The standard deviation of the sampling distribution of a statistic is known as its Standard Error.

4) State any two merits of simple random sampling.

Answer : 1. This method is economical as it saves time, money and labour.
2. Personal bias is completely eliminated.

5) What is interval estimation?

Answer : Generally, there are situations where point estimation is not desirable and we are interested in finding limits within which the parameter would be expected to lie is called an interval estimation.

6) What is confidence interval?

Answer : The interval within which the unknown value of parameter is, expected to lie is called confidence interval. It indicates the probability that the population parameter lies within a specilied range. If o is the population paramcter, then we choose a small value a, known as level of significance (1% or 5%) and determine 2 constants c, and c,such that p(c_1 < 0 < c_2/t) = 1- α. When t is the value of statistic. The quantities c_1 and c_2 are determined as confidence limits and the interval [c_1, c_2] within which the unknown value of the population parameter is expected to lieis known as confidence interval.

7) What is null hypothesis? Give an example.

Answer : Null hypothesis is the hypothesis which is tested for possible rejection under the assumption that it is true and it is denoted by H_0.
Example: If we want to find the population mean has a specific value μ_o, then the null hypothesis H_o is $H_o : \mu = \mu_0$

8) Define critical value.

Answer : The value of test statistic which separates the critical (or rejection) region and the acceptance region is called the critical value or significant value.

9) What is type I error.

Answer : The error of rejecting H_o when it is true is type I error.

10) What is single tailed test.

Answer : When the hypothesis about the population parameter is rejected only for the value of sample statistic falling into one of the tails of the sampling distribution, then it is known as one tailed test.

3 Marks 5 x 3 = 15

11) Using the following random number table (Kendall-Babington Smith)

23	15	75	48	59	01	83	72	59	93	76	24	97	08	86	95	23	03	67	44
05	54	55	50	43	10	53	74	35	08	90	61	18	37	44	10	96	22	13	43
14	87	16	03	50	32	40	43	62	23	50	05	10	03	22	11	54	36	08	34
38	97	67	49	51	94	05	17	58	53	78	80	59	01	94	32	42	87	16	95
97	31	26	17	18	99	75	53	08	70	94	25	12	58	41	54	88	21	05	13

Draw a random sample of 10 four- figure numbers starting from 1550 to 8000.

Answer : Here, we have to select 10 random numbers ranging from 1550 to 8000 but the given random number table has only 2 digit numbers. To solve this, two - 2 digit numbers can be combined together to make a four- figure number. Let us select the 5th and 6th column and combine them to form a random number, then select the random number with given range. This gives 5 random numbers, similarly, 8th and 9th is selected and combined to form a random numbers, then select the random number with given range. This gives 5 random numbers, totally 10 four- figure numbers have been selected. The following table shows the 10 random numbers which are combined and selected.

23	15	75	48	59	01	83	72	59	93	76	24	97	08	86	95	23	03	67	44
05	54	55	50	43	10	53	74	35	08	90	61	18	37	44	10	96	22	13	43
14	87	16	03	50	32	40	43	62	23	50	05	10	03	22	11	54	36	08	34
38	97	67	49	51	94	05	17	58	53	78	80	59	01	94	32	42	87	16	95
97	31	26	17	18	99	75	53	08	70	94	25	12	58	41	54	88	21	05	13

Therefore the selected 10 random numbers are

5901	4310	5032	5194	1899
7259	7435	4362	1758	5308

12) The standard deviation of a sample of size 50 is 6.3. Determine the standard error whose population standard deviation is 6?

Answer : Sample size n = 50

Sample S.D s = 6.3

Population S.D σ = 6

The standard error for sample S.D is given by

$$S.E=\sqrt{\frac{\sigma^2}{2n}}=\frac{6}{\sqrt{2(50)}}=\frac{6}{\sqrt{100}}=0.6$$

Thus standard error for sample S.D = 0.6.

13) A wholesaler in apples claims that only 4% of the apples supplied by him are defective. A random sample of 600 apples contained 36 defective apples. Calculate the standard error concerning of good apples.

Answer : Sample size N = 600

Population proportion P = 4% = .04

Q = 1-P = 1-.04

Q = 0.96

∴ The standard error for sample proportion is given by

$$S.E=\sqrt{\frac{PQ}{N}}=\sqrt{\frac{(.04)(.96)}{600}}$$

$$=\sqrt{\frac{0.0384}{600}}=\sqrt{.000064}$$

S.E=.008

14) A sample of 1000 students whose mean weight is 119 lbs(pounds) from a school in Tamil Nadu State was taken and their average weight was found to be 120 lbs with a standard deviation of 30 lbs. Calculate standard error of mean.

Answer : Given $n=1000, \bar{X}=119, \sigma=30$

$$S.E=\sigma/\sqrt{n}$$

$$=30/\sqrt{1000}$$

$$=30/31.623=0.9487$$

15) A sample of 100 items, draw from a universe with mean value 4 and S.D 3, has a mean value 63.5. Is the difference in the mean significant at 0.05 level of significance?

Answer : Sample size n = 100,

Sample mean $\bar{X} = 3.5$

Population mean μ = 4

Population standard deviation σ = 3

Null Hypotheses: There is no significant difference in the mean. i.e., H_o : μ = 4

Alternative Hypotheses : There is Significant difference in the mean.

i.e., H_1 : μ ≠ H

The level of significance ∝ = 5% = 0.05

Applying the test statistic, $Z = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$

$\Rightarrow Z = \frac{3.5-4}{\frac{3}{\sqrt{100}}} = \frac{-.5}{.3} = -1.667$

$\Rightarrow |Z| = 1.667$

$Z_{\frac{\alpha}{2}} = 1.96$

Here Z < $Z_{\frac{\alpha}{2}}$ i.e., 1.667< 1.96

Inference: Since Z< $Z_{\frac{\alpha}{2}}$ at 5% level of significance, the null hypothesis H_0 is accepted. Hence there is no Significant difference in the mean.

5 Marks

3 x 5 = 15

16) Explain in detail about systematic random sampling with example.

Answer : In systematic sampling, randomly select the first sample from the first k units. Then every k^{th} member, starting with the first selected sample, is included in the sample.

Procedure for selection of samples by systematic sampling method.

(I) If we want to select a sample of 10 students from a class of 100 students, then $k = \frac{N}{n} = \frac{100}{10} = 10$

Thus, sampling interval = 10 denotes that for every 10 samples one sample has to be selected.

(II) If the selected first random sample is 5, then the rest of the samples are automatically selected as 5, 15, 25, 35, 45, 55, 65, 75, 85, 95.[∵ k = 10]

17) A sample of 400 individuals is found to have a mean height of 67.47 inches. Can it be reasonably regarded as a sample from a large population with mean height of 67.39 inches and standard deviation 1.30 inches at 0.05 level of significance?

Answer : Given Sample size n = 400

Sample mean $\bar{X} = 67.47$inches

Population mean μ = 67.39 & σ = 1.30 inches)

Null Hypotheses H_o:

μ = 67.39 inches (i.e., the sample has been drawn from the population with μ = 67.39 & σ = 1.30 inches)

Alternative Hypotheses H_1:

μ ≠ 67.39 inches (two tail test)

(i.e., the sample has not been drawn from the population with μ = 67.39 & σ = 1.30 inches) The level of significance a = 5% = 0.05

Applying the test statistic,

$Z = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$

$\Rightarrow Z = \frac{67.47-67.39}{\frac{1.30}{\sqrt{400}}} = \frac{0.08}{0.065} = 1.2308$

$\therefore |Z| = 1.2308$

The significant value $Z_{\frac{\alpha}{2}} = 1.96$

Here $Z = Z_{\frac{\alpha}{2}} i.e., 1.2308 < 1.96$

Inference: Since $Z_{\frac{\alpha}{2}}$ at 5% level of significance the null hypothesis H_o is accepted.

Hence, we conclude that the sample has been drawn from the population with mean height 67.39 inches and standard deviation 1.30 inches.

18) The average score on a nationally administered aptitude test was 76 and the corresponding standard deviation was 8. In order to evaluate a state's education system, the scores of 100 of the state's students were randomly selected. These students had an average score of 72. Test at a significance level of 0.05 if there is a significant difference between the state scores and the national scores.

Answer : Sample size n = 100

Sample mean $\bar{X}$= 72

Population mean μ = 76

Population standard deviation σ = 8

Null Hypotheses H_0:

μ = 76(i.e., There is no Significant difference between the state scores and the national scores)

$$Z = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}}$$

$$\Rightarrow Z = \frac{72-76}{\frac{8}{\sqrt{100}}} = \frac{-4}{\frac{8}{10}} = \frac{-4}{8} = -5$$

$$\Rightarrow |Z| = 5$$

$$Z_{\frac{\alpha}{2}} = 1.96$$

$$Z > Z_{\frac{\alpha}{2}} i.e., \ 5 > 1.96$$

Inference : Since $Z > Z_{\frac{\alpha}{2}}$ at 5% level of significance, the null hypothesis H_0 is rejected.

Hence, we conclude that there is significant difference between the state scores and the national scores.