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SEAT No. :

P978

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[6054]-214

S.Y. B.Sc. (Regular)

STATISTICS

ST-241 : Tests of Significance and Statistical Methods

(2019 Pattern) (CBCS) (Semester - IV) (Paper - I) (24171)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of statistical tables and calculator is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following:

A) In each of the following cases, choose the correct alternative: [1 each]

a) $100(1-\alpha)\%$ confidence interval for population mean μ when population variance is known

i) $\left(\bar{X} - z_{\alpha/2} \frac{\sigma^2}{n}, \bar{X} + z_{\alpha/2} \frac{\sigma^2}{n} \right)$

ii) $\left(\bar{X} - z_{\alpha/2} \frac{\sigma}{n}, \bar{X} + z_{\alpha/2} \frac{\sigma}{n} \right)$

iii) $\left(\bar{X} - z_{\alpha/2} \frac{\sigma}{\sqrt{n}}, \bar{X} + z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \right)$

iv) $\left(\bar{X} - z_{\alpha/2} \frac{\sigma^2}{\sqrt{n}}, \bar{X} + z_{\alpha/2} \frac{\sigma^2}{\sqrt{n}} \right)$

b) The following death rate is used for the comparison of the mortality of the two populations A and B

- | | |
|------------------------|-----------------------------|
| i) Crude Death Rate | ii) Specific Death Rate |
| iii) Infant Death Rate | iv) Standardized Death rate |

P.T.O.

c) The range in which partial correlation coefficient lies is

- i) $-\infty$ to ∞
- ii) 0 to 1
- iii) -1 to 1
- iv) 0 to ∞

B) In each of the following, state whether the given statement is true or false. **[1 each]**

- a) $X_{1.23}$ is called as residual of order 2.
- b) Infant mortality rate is the number of deaths of children under 1 years of age per 1000 lives of birth.

Q2) Attempt any two of the following: **[5 each]**

a) The mean height obtained from a sample of size 100 taken randomly from a population is 160 cm. If the standard deviation of height of population is 8 cm. Test whether the mean height is 163 cm. against the alternative that it is less than 163 cm.

b) Show that $R_{1.23}^2 = b_{12.3} r_{12} \frac{\sigma_2}{\sigma_1} + b_{13.2} r_{13} \frac{\sigma_3}{\sigma_1}$

c) Customers arrive at a certain petrol pump in pune in a Poisson process with an average time of 5 minutes between arrivals. The time interval between services at the petrol pump follow exponential distribution and the mean time taken to service a vehicle is 2 minutes.

- i) Find the probability that the pump is busy.
- ii) What would be expected queue length?
- iii) What is expected length of the system.
- iv) Find the probability that there are 3 customers in the system.

Q3) Attempt any two of the following: **[5 each]**

- a) Explain the terms:
 - i) Type I error
 - ii) Type II error
 - iii) Level of significance
 - iv) Critical region
 - v) One tailed hypothesis

- b) If $X_1=Y_1+Y_2$, $X_2=Y_2+Y_3$, $X_3=Y_3+Y_1$ where Y_1, Y_2, Y_3 are mutually uncorrelated variables with mean zero and unit standard deviation. Find the multiple correlation coefficient between X_1 and (X_2, X_3) .
- c) Calculate Total Fertility rate (T.F.R.) and Gross Reproduction Rate (G.R.R) by considering proportion of female births as 0.48, for the following data:

Age-group	15-19	20-24	25-29	30-34	35-39	40-44
Population (in thousand)	16	26	21	18	11	11
Age-S.F.R.	60	285	322	260	125	10

Q4) Attempt any one of the following: [10 each]

- a) i) Explain briefly, the large sample test for testing $H_0 : \mu_1 = \mu_2$ against $H_1 : \mu_1 \neq \mu_2$, where μ_1 and μ_2 are population means from which the two independent samples are drawn. It is assumed that the population variances are known. [6]
- ii) Explain the following terms:
Customer, calling population, waiting time and time spent in the system. [4]
- b) i) A random sample of 200 bolts manufactured by machine A and 100 bolts manufactured by machine B showed that 19 and 5 defective bolts respectively. Is machine B better than A? [5]
- ii) Define crude death rate and standardized death rate. Explain direct method of standardization. [5]



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S.Y. B.Sc.

STATISTICS

ST-242 : Sampling Distribution and Exact Tests
(2019 Pattern) (CBCS) (Semester - IV) (Paper - II) (24172)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates :

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of statistical tables and calculator is allowed.*
- 4) *Symbols and abbreviations have their usual meaning.*

Q1) Attempt each of the following :

a) In each of the following cases, choose the correct alternative : **[1 each]**

i) Let $X \rightarrow G(2, 3)$ then distribution of random variable $Y = \frac{x}{2}$ is

- | | |
|----------------|----------------|
| A) $G(2, 3/2)$ | B) $G(1, 3)$ |
| C) $G(4, 3)$ | D) $G(1, 3/2)$ |

ii) If mode of χ^2 random variable is 8 then it's variance is :

- | | |
|-------|-------|
| A) 6 | B) 10 |
| C) 20 | D) 16 |

iii) If $X \rightarrow F(5, 5)$ then median of X is

- | | |
|------|----------|
| A) 1 | B) 2 |
| C) 5 | D) $3/7$ |

b) In each of the following, state whether the given statement is true or false : **[1 each]**

- i) The t-distribution is symmetric about 1.
- ii) For test based on t-distribution, the value of the test statistics cannot be negative.

P.T.O.

Q2) Attempt any two of the following : **[5 each]**

- a) State and prove the additive property of gamma distribution, also state the distribution of sample mean \bar{X} .
- b) If a r.v.t. follows t-distribution with n degrees of freedom then find distribution of $Y = \frac{1}{1 + \frac{t^2}{n}}$.
- c) Describe the test procedure for testing $H_0 : \sigma_1^2 = \sigma_2^2$ against $H_0 : \sigma_1^2 \neq \sigma_2^2$.

Q3) Attempt any two of the following : **[5 each]**

- a) Show that mode of F-distribution with n_1 and n_2 d.f. is, $\frac{n_2(n_1 - 2)}{n_1(n_2 + 2)}, n_1 > 2$.
- b) Define χ^2 variate with n degrees of freedom. Find it's mean and variance.
- c) Identify the distribution of a r.v.X if it's m.g.f is $M_x(t) = \left(1 - \frac{t}{1/2}\right)^{-20}$ where $t < 1/2$, also find the median and mode of X.

Q4) Attempt any **one** of the following :

- a) i) Let X_1, X_2, \dots, X_{10} be independent and identically distributed $N(20, 20)$ variates. Calculate **[5]**
$$P\left[\sum_{i=1}^8 (X_i - 20)^2 \geq 190.48\right]$$
- ii) Explain paired t-test along with the assumptions made. **[5]**
- b) i) Let \bar{X} and S^2 be the mean and variance of a random sample of size 25 from $N(3, 100)$ distribution.
Evaluate $P(0 < \bar{X} < 6, 55.2 < S^2 < 145.6)$ **[5]**
- ii) Let t_{25} follows Student's t-distribution with 25 degrees of freedom find 'k' such that $P(-k < t_{25} < k) = 0.3$. **[2]**
- iii) State the inter-relations among normal, chi-square, t and f-distribution. **[3]**

