BACHELOR OF ARTS EXAMINATION, 2025
(CBCS, OLD, UG/ECO/SE 3.1)

(1st Year, 3rd Semester)

ECONOMICS

PAPER : EX/ECO/B/SE/3.1(OLD)/2025

(Advanced Statistics)

Time : *Two Hours* *Full Marks* : 30

Answer *any* **three** from the following questions :

1. *(a)* Four roads lead away from the jail. A prisoner has escaped from the jail and selects a road at random. If road I is selected, the probability of escaping is 1/8; if road II is selected, the probability of success is 1/6; if road III is selected, the probability of escaping is 1/4; and if road IV is selected the probability of success is 9/10. What is the probability that the prisoner will succeed in escaping? If the prisoner succeeds, what is the probability that the prisoner escaped by using road I?

(b) The probability of getting no misprint in a page of a book is 0.14. What is the probability that a page contains more than 2 misprints? If the book is of 1500 pages, find out the expected number of pages containing more than 2 misprints. 5+5

2. *(a)* Given a random sample of size n from a population that has the unknown mean μ and the finite unknown variance σ^2, show that $\frac{1}{n}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2$ is a biased estimator of σ^2 where $x_1, x_2, \ldots, x_n$ are sample observations. 4

(b) The following categorized data gives the classification of 95 people according to their intelligence and mood upon getting up in the morning.

Mood	Intelligence		
	Intelligent	Average	Below average
Good	10	8	5
Tolerable	8	9	10
Intolerable	5	6	14

Test whether there is any evidence of association between these characteristics (Test for independence). 6

3. *(a)* Evaluate the covariance between X and Y if the joint probability distribution of X and Y is as follows :

Y \ X	0	2
0	1/4	1/4
1	1/4	1/4

(b) Are X and Y independent for the above joint distribution?

(c) $x_1, x_2, \ldots, x_n$ are independent observations from a Normal distribution with both mean and variance equal to an unknown parameter $\theta > 0$ i. e. the probability density of x_i is

$$f(x_i, \theta) = \frac{1}{\sqrt{\theta 2\pi}} e^{-\frac{(x_i-\theta)^2}{2\theta}}$$

What is the Maximum Likelihood Estimation (MLE) of θ? 4+2+4

4. *(a)* Suppose the variable X follows Normal distribution with mean $\mu = 2$, sd $\sigma = 4$. What is the probability that X will take a value greater than 10? 3

(b) A random sample of 12 married teenage girls shows an average I.Q. of 90 with a standard deviation of 2. Assuming a normal distribution for the I.Q.'s construct a 99% confidence interval for population (σ^2) variance where the true variance is unknown. 5

(c) What do you mean by consistency of an estimator? 2

5. *(a)* Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins show the sample standard deviations of their weights as 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test the hypothesis that the true variances are equal, against the alternative that they are not, at the 90% level. 5

(b) State the classical definition of probability and also discuss its limitations. 5

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