Reg. No..................................   (Pages : 2)   **K 6161**

Name ....

SECOND YEAR B.Sc. DEGREE EXAMINATION, APRIL/MAY 2005

Part III—Statistics—(Subsidiary) to Physics Main

Paper II—PROBABILITY DISTRIBUTIONS, LIMIT THEOREMS AND STATISTICAL INFERENCE

Time : Three Hours   Maximum : 50 Marks

Not more than 10 *marks will be awarded from each Unit.*

Unit I

1. Show that, under some conditions to be stated, binomial distribution tends to the Poisson distribution.

(4 marks)

2. Describe a situation in which negative binomial probabilities are obtained. Why it is called 'negative binomial' ?

(2 + 2 = 4 marks)

3. Define an exponential distribution and obtain its mean and variance. (4 marks)

4. For a uniform distribution over $(0, \theta)$, mean and variance are equal. Then what is the value of (θ) ?

(4 marks)

5. If x_1 and x_2 are two independent normally distributed random variables with means 10 and 20 and variances 9 and 16 respectively, obtain $P(60 \le 2x_1 + 3x_2 \le 8\,t)$

(4 marks)

Unit II

6. Establish Tchebychev's Inequality. (4 marks)

7. If X is the number scored in a throw of a fair die, show that $P(|X - 3.5| > 2.5) < .47$ compare it with the actual probability.

(4 marks)

8. State and prove Bernoulli's law of large numbers. (4 marks)

9. State Windberg-Levy form of Central Limit theorem. Apply it to the Poisson distribution.

(2 + 2 = 4 marks)

10. The life of a certain brand of an electronic bulb may be considered as a random variable with mean 1200 hours and standard deviation 250 hours. Find the probability using CLT, that the average life time of 60 bulbs exceeds 1400 hours.

(4 marks)

Unit III

11. Explain the terms (a) sampling distribution and (b) standard error. (3 marks)

12. Distinguish between parameters and statistics giving examples. (3 marks)

Turn over

13. Derive the sampling distribution of the mean of a sample taken from the normal population $N(\mu, \sigma^2)$.

(4 marks)

14. Explain Chi-square and t distributions and their uses. (4 marks)

15. What is a simple random sample ? Explain how you will estimate the population means.

(3 marks)

16. Explain the basic ideas of stratified sampling and systematic sampling. (3 marks)

Unit IV

17. (a) State the desirable properties of a good estimate.

(b) State Cramer-Rao inequality.

(2 + 2 = 4 marks)

18. If x_1, x_2, x_3 are three random observations from a Poisson Population with parameter λ, show that $\bar{x} = \frac{x_1 + x_2 + x_3}{3}$ is unbiased and sufficient for λ.

(2 + 2 = 4 marks)

19. State the sufficient conditions for consistency and show that the sample mean is a consistent estimation of population mean.

(4 marks)

20. What do you mean by a minimum variance bound estimator ? Obtain the MVB estimator for the mean μ in a normal population $N(\mu . \sigma^2)$

(4 marks)

21. State Factorisation theorem for sufficiency. Verify this in the case of sample mean from a normal population $N(\mu . \sigma^2)$ while estimating the population mean μ.

(4 marks)

Unit V

22. Explain the terms : (i) Acceptance Region and Critical Region ; (ii) Significance level and power.

(4 marks)

23. State Neyman-Pearson theorem for test construction. Using this derive the best test of level α for testing the mean of a normal population $N(\mu, \sigma^2), \sigma^2$ known.

(4 marks)

24. When do you use student's t-test ? What is the use of F-test ? (4 marks)

25. How will you test the significance of an observed correlation coefficient r, from a sample of n bivoniate observations.

(4 marks)

26. What is analysis of variance ? What are the assumptions of analysis of variance ? Describe the one-way model, stating the assumptions.

(4 marks)