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Reg. No:......................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2022

BST3C07 – Probability Distributions and Parametric Tests

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

SECTION-A

Each question carries 2 Marks.

Maximum Marks that can be scored in this section is 20.

1. If X is normally distributed with mean 10 and variance 2.25, find $P(8 < X < 12)$.
2. State the central limit theorem.
3. Define sampling.
4. Distinguish between population and sample.
5. Distinguish between cluster and stratum.
6. What is meant by *p* value?
7. Can you reject the hypothesis of a two tailed large sample test for testing the significance of a population mean for 1% level of significance if the value of the test statistic is 1.95?
8. Define critical value.
9. Define level of significance and power of the test.
10. Write the mean and variance of the test statistic of a large sample test.
11. Write the rejection rule of the F test for testing the equality of population variances.
12. Consider a t test for testing the significance of correlation with sample size 19. If the level of significance is 0.01 determine the critical value.

SECTION-B

Each question carries 5 Marks.

Maximum Marks that can be scored in this section is 30.

13. Explain Normal distribution and its properties.
14. If the mean and variance of a binomial distribution are 4 and 2, find the probabilities of (i) exactly 3 successes, (ii) more than 2 successes and (iii) at least 1 success.
15. Describe i) Simple random sampling and ii) Systematic sampling.
16. Discuss the large sample test for testing the significance of the equality of population means of two independent populations.

17. If $X > 18$ is the critical region for testing $H_0: \theta = 2$ against $H_1: \theta = 4$ on the basis of a single observation from a population with pdf $f(x)=\begin{cases}\theta e^{-\theta x}, & 0<x<\infty \\ 0 & , otherwise\end{cases}$ compute the power of the test.

18. Discuss the Chi square test for testing the significance of the variance of a Normal population.

19. Certain diet was fed to 10 Guinea pigs and the following increases in weights have been noted as 2.2, 3.4, -0.8, 1.3, -1.0, -0.7, 2.3, 2.6, -1.3 and 2.4. It is assumed that the weights following normal distribution. Test whether the diet has any significant effect on the weight of mice.

SECTION C

(Answer *any one* Question and carries 10 marks)

20. Fit a Poisson distribution for the following data

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21. In a sample of 700 people from Town A, 370 are found to be coffee drinkers. In another sample of 1000 from Town B, 580 are found to be coffee drinkers. Do the data indicate that the two towns are significantly different with respect to the preference of coffee?

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2022

BST3B03 – Statistical Estimation

(2019 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A

All questions can be attended. Each question carries 2 marks.

1. Define Pareto distribution.
2. Obtain the moment generating function of uniform distribution.
3. Mention the relationship between exponential and gamma distribution.
4. Define log normal distribution.
5. State lack of memory property of exponential distribution.
6. Distinguish between standard error and standard deviation.
7. A sample of size 16 is taken from a normal population with mean 1 and standard deviation 1.5. Find the probability that the sample mean is negative.
8. Establish the relationship between t and F distributions.
9. Define likelihood function.
10. Show that sample variance is not an unbiased estimator of the population variance for a normal population.
11. Find the MLE of θ for a uniform distribution defined in the interval $[0, \theta]$.
12. What is the significance of Bayesian estimation method?
13. What do you mean by interval estimation?
14. Write 95% confidence interval for μ of a normal population when σ is known.
15. A random sample of size 11 from a normal population is found to have variance 12.3. Find a 95% confidence interval for the population variance.

Maximum Marks = 25

PART B

All questions can be attended. Each question carries 5 marks.

16. X is a normal variate with mean 30 and standard deviation 5. Find the probabilities of (1) $26 \leq X \leq 40$ (2) $X \geq 45$ (3) $|X-30| > 5$.

17. If $X \sim \beta_1(p, q)$ then obtain the distribution of $Y = \frac{X}{1-X}$.

18. Obtain the expression for limiting form of Chi-square distribution.

19. Define F statistic. Derive mode of F distribution.

20. Define efficiency and compare the efficiencies of $\frac{X_1+2X_2+3X_3}{6}$ and $\frac{X_1-2X_2+5X_3}{4}$, the unbiased estimators of mean μ when $X_i \sim N(\mu, \sigma^2)$.

21. 3.5, 1.8, 2.9, 6.5, 4.5, 2.1, 5.8 is a random sample from a population whose pdf is $f(x) = \frac{1}{2}e^{-|x-\theta|}; -\infty < x < \infty; -\infty < \theta < \infty$, Obtain the maximum likelihood estimator of θ.

22. Derive confidence interval for difference of proportions of two populations.

23. The average height of 10 students who have interest in playing basket ball is 70 per inches with a SD of 2.5 inches while 15 students who have no interest in playing basket ball had a mean height of 67 inches with a SD 2.8 inches. Find the 95% CI for difference of means.

Maximum Marks = 35

PART C

Each question carries 10 marks (Answer any TWO questions).

24. State and prove Lindberg-Levy Central Limit theorem.

25. Define t distribution and derive the expression for moments. Hence find measures of skewness and kurtosis.

26. State and prove Cramer -Rao inequality.

27. A study of teenage suicide included a sample of 96 boys and 123 girls between ages of 12 and 15 years selected scientifically from admissions records to a private psychiatric hospital. Suicide attempts were reported by 18 of the boys and 60 of the girls. We assume that the girls constitute a simple random sample from a population of similar girls and likewise for the boys. Construct a 99% confidence interval for the differences between the two proportions.

(2 x 10 = 20 Marks)

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Reg. No:.......................

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Mathematics Degree Examination, November 2022

BST3C03 – Probability Distributions and Sampling Theory

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

Part A

All questions can be attended.

Each question carries 2 marks.

1. Write down the pdf of exponential distribution. Derive its distribution function.
2. State the conditions under which Binomial distribution approaches Poisson distribution.
3. Derive the mean and variance of the uniform distribution (continuous).
4. An agent sells life insurance policies to five equally aged, healthy people. According to recent data, the probability of a person living in these conditions for 30 years or more is 2/3. Calculate the probability that after 30 years, all five people are still living.
5. Distinguish between parameter and statistic. Give one example for each.
6. Explain the term convergence in distribution.
7. If $E(X) = 3$ and $E(X^2) = 13$, use Chebyshev's inequality to find a lower bound for $P(-2<X<8)$.
8. Explain cluster sampling.
9. Distinguish between simple random sampling with replacement and without replacement.
10. What do you mean by sampling distribution? Give one example.
11. Define F statistic. Write down its pdf.
12. Give an example of a statistic following t distribution.

(Ceiling 20 marks)

Part A

All questions can be attended.
Each question carries 5 marks.

13. Establish the recurrence relation for the central moments of Binomial distribution.
14. Write down the pdf of the Normal distribution. State its important properties.
15. State and prove Chebychev's in equality.
16. What is the probability of obtaining more than 520 heads in 1000 tosses of a fair coin?
17. $\{X_k\}$, k= 1, 2,...is a sequence of independent random variables each taking the value -1,0,1. Given that $P\{X_k = 1\} = P\{X_k = -1\} = \frac{1}{k}$ and $P\{X_k = 0\} = 1 - \frac{2}{k}$; examine whether the weak law of large numbers hold for the sequence.
18. Explain stratified random sampling. Give an example where you can use this method.
19. Establish the relationship between t, chi-square and F distributions.

(Ceiling 30 marks)

Part C

Answer any one question. The question has TEN marks.

20. i)Define Gamma distribution. Derive its mean, variance and mgf.

    ii)Give the relationship between garama, χ^2 and exponential distribution.

21. i) Derive the sampling distribution of the sample mean if samples are taken from N(μ, σ).

    ii) Obtain the distribution of the linear combination of n independent normal variables.

(1x 10 =10marks)

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Reg. No:......................

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2022

BAS3C03 – Life Contingencies and Principles of Insurance

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

PART-A (Short Answer)
All questions can be attended
Each question carries two marks.

1. Define Annual Premium Contract.
2. Define Prospective Reserve.
3. What do you mean by True Fractional Premiums?
4. What do you mean by Apportionable Premium?
5. Define Net Premium.
6. Define a True monthly premium contract.
7. Define Marine Insurance.
8. Define Motor Insurance.
9. What do you mean by pecuniary loss?
10. What does risk aversion mean?
11. What is a utility function?
12. What is optimal insurance?

Maximum Marks = 20

PART-B (Paragraph)
All questions can be attended
Each question carries five marks.

13. Derive a formula for the variance of the insurer's profit on a whole life assurance policy issued to a life aged x. Assume that level premiums are payable annually in advance and the sum assured is payable at the end of the year of death.
14. Distinguish between life and general insurance
15. Discuss the limitations of utility theory.
16. Briefly explain Marine and Aviation Insurance.
17. Calculate the annual premium for a term assurance with a term of 10 years to a male aged 30, with a sum assured of £500,000, assuming AM92 Ultimate mortality and interest of 4% *pa*. Assume that the death benefit is paid at the end of the year of death.

18. A life aged exactly 50 buys a 15-year endowment assurance policy with a sum assured of £50,000 payable on maturity or at the end of the year of earlier death. Level premiums are payable monthly in advance. Calculate the monthly premium assuming AM92 Ultimate mortality and 4% *pa* interest. Ignore expenses.

19. A whole life annuity is issued to a life aged x . The annuity is purchased by a single premium and a benefit of 1 is payable at the beginning of every year throughout life. Show that the net prospective and retrospective reserves are equal.

Maximum Marks = 30

PART-C (Essay)

Answer any one question. Each question carries ten marks.

20. Explain benefit reserve for a general fully continuous insurance and develop a retrospective formula for the benefit reserve.

21. A fully discrete n-year endowment insurance on (x) provides, in case of death within n years, a payment of 1 plus the benefit reserve. Obtain formulas for the level benefit premium and the benefit reserve at the end of k years, given that the maturity value is 1.

(1 x 10 = 10 Marks)