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Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

First Degree Programme Under CBCSS

Statistics

Complementary Course for Physics

ST 1331.2 – PROBABILITY DISTRIBUTIONS AND STOCHASTIC PROCESS

(2019 & 2020 Admission)

Time : 3 Hours Max. Marks : 80

Use of calculator and statistical table is permitted.

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Binomial distribution was discovered by ——————.

2. If the mean of Poisson distribution is 4, then what is its variance?

3. Name the discrete distribution which satisfies the lack of memory property.

4. What is standard normal variate?

5. If the mean recurrence time is finite, then the recurrent state of Markov chain is known as ——————

6. The square of standard normal variate is called ——————

7. How many sub population of size K can be drawn from a population of size N?

8. What is the mean of t distribution?

9. A random process that is not stationary in any sense is called ____________

10. If arrivals are according to Poisson process, then distribution of inter arrival times is ____________.

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions. **Each** question carries **2** marks.

11. Define discrete uniform distribution. Find its mean.

12. If the chance that a vessel arrives safely at a port is 9/10, find the probability that out of five vessels expected at least four vessels will arrive safely.

13. Explain briefly the utility of Poisson distribution in real situations.

14. Give the importance of normal distribution in statistics.

15. Define Weibull distribution.

16. Distinguish between statistic and parameter.

17. State central limit theorem.

18. Define F distribution.

19. Define pairs and multiplets.

20. What is Bose Einstein statistics?

21. Define stochastic process. Give an example.

22. Find the distribution function of exponential distribution.

23. Define stochastic process with independent increments.

24. What is Brownian motion process?

25. Write down the binomial distribution, if the mean and variance of the distribution are respectively 4 and 3.

26. Define beta distribution of the first kind.

($8 \times 2 = 16$ Marks)

SECTION – C

Answer any **six** questions. Each question carries **4** marks.

27. Derive moment generating function of binomial distribution and hence find its mean.

28. If X and Y are independent Poisson variates such that $P(X = 1) = P(X = 2)$ and $P(Y = 2) = P(Y = 3)$. Find the variance of $X - 2Y$.

29. Define geometric distribution. Find its mean.

30. Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 inches. How many soldiers in a regiment of 1000 would you expect is being over six feet tall?

31. Show that exponential distribution lacks memory.

32. Stating Poisson postulates, define Poisson process.

33. Define transition probability. How transition probabilities together with initial distribution specify a Markov chain?

34. Explain Markov process and Markov chain. What is irreducible Markov chain?

35. Define Fermi Dirac distribution. What does Fermi Dirac distribution represent?

36. Explain subpopulations and partitions.

37. Write short notes on Maxwell-Boltzmann statistic.

38. Define gamma distribution with two parameters. Obtain its mean.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

39. (a) Define binomial distribution. Find variance of the distribution.

(b) Fit a binomial distribution to the following data and calculate expected frequencies:

X	0	1	2	3	4
f	28	62	46	10	4

7+8 =15

40. (a) Derive the recurrence relation for the moments of Poisson distribution and hence find its first four central moments.

(b) State and establish the additive property of Poisson distribution.

(c) If X follows Poisson distribution and $P(X = 1) = P(X = 2)$. Find the mode of the distribution.

8+4+3 =15

41. (a) Explain classification of stochastic processes with respect to state space and time space. Give examples.

(b) Describe a simple random walk process.

(c) Let $\{X_n, n = 0, 1, 2...\}$ be a Markov chain with states 0, 1, 2 with transition probability matrix.

$$\begin{pmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{pmatrix}$$

and initial distribution $P(X_0 = i) = 1/3$ for $i = 0, 1, 2$.

Find $P(X_0 = 2, X_1 = 1, X_2 = 2)$.

8+3+4 =15

42. (a) Define normal distribution. State chief characteristics of normal distribution.

(b) If X is a continuous random variable and uniformly distributed with mean 1 and variance 4/3, find $P(X < 0)$.

(c) Define negative binomial distribution. How geometric distribution is a particular case of negative binomial distribution?

8+4+3 = 15

43. (a) Explain classification of states of a Markov Chain.

(b) Consider the Markov chain with transition probability matrix.

$$\begin{pmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{pmatrix}$$

Classify the Markov chain and its states. Also find the period of states of Markov chain.

6+9 =15

44. (a) Derive the moment generating function of chi-square distribution and hence find its mean.

(b) Define t statistic and its distribution. Write down the relation between chi-square, t and F distributions.

(c) Write down the sampling distribution of variance of a random sample from normal distribution.

8+5+2 =15

(2 × 15 = 30 Marks)
