M 5272

Reg. No. : ....

Name : ....

III Semester B.A./B.Sc./B.Com./B.B.A./B.B.A.T.T.M./B.B.M./B.C.A./B.S.W./ B.A. Afsal-Ul-Ulama Degree (CCSS – Regular/Supple./Improvement) Examination, November 2013
CORE COURSE IN STATISTICS
3B03 STA : Probability Theory

Time: 3 Hours　　　　　　　　　　　　　　　　　　　　Max. Weightage : 30

Instruction :* *Use of calculators and statistical tables are* ***permitted.

PART – A

Answer **any 10** questions.　　　　　　　　　　　　　　　**(Weightage one each)**

1. One card is selected at random from 25 cards numbered 1 to 25. Find the probability that the number on the card is even and divisible by 3.

2. Define relative frequency of an event and give the statistical definition of probability.

3. Let A and B be events such that $P(A) = 0.4$, $P(B) = 0.7$, $P(A \cap B) = 0.3$, calculate $P(A \cap \overline{B})$.

4. Define :
   1) Mutually exclusive
   2) Independent events.

5. A coin is tossed twice. If X denote the number of tails obtained, find the probability distribution of X.

6. A random variable X has pdf $f(x) = \frac{1}{4}, -2 < x < 2$ and zero otherwise. Determine $P(|X| > 1)$.

7. State necessary and sufficient condition for independence of 2 random variables in terms of joint pdf and marginal pdfs.

P.T.O.

8. List any 2 properties of joint distribution function F(x, y).

9. State Addition theorem on expectation for n random variables $X_1, X_2, \ldots X_n$.

10. If it rains, a dealer in raincoats can earn Rs. 400 per day. If it is fair, he may lose Rs. 50 per day. What is his expected earnings if probability of a fair day is 0.6 ?

11. Show that $M_{CX}(t) = M_X(Ct)$ where C is a constant. **(10×1=10)**

PART – B

Answer **any 6** questions. **(2 each)**

12. Define probability space associated to random experiment, briefly explaining the terms involved.

13. If A, B and C are three events, show that $P(A \cup B/C) = P(A/C) + P(B/C) - P(A \cap B/C)$.

14. Let X be a random variable with pdf f(x) = 2x, 0 < x < 1 and zero elsewhere. Find the pdf of Y = 3X + 1.

15. Two discrete random variables X and Y have $P(X = 0, Y = 0) = \frac{2}{9}$, $P(X = 0, Y = 1) = \frac{1}{9}$, $P(X = 1, Y = 0) = \frac{1}{9}$ and $P(X = 1, Y = 1) = \frac{5}{9}$. Examine whether X and Y are independent.

16. If X and Y are independent random variables, show that $V(aX + bY) = a^2 V(X) + b^2 V(Y)$.

17. Let f(x, y) = 8xy, 0 < x < y < 1 and zero elsewhere, find $f_1(x)$, f(y/x).

18. Show that $\mu_r' = \frac{d^r}{dt^r}(M_X(t))\Big/_{t=0}$.

19. Prove that cumulant $K_1 = \mu_1'$ and $K_2 = \mu_2$.

20. Define Probability generating function of a discrete random variable. Give the relationship between this junction and moment generating function. **(6×2=12)**

PART – C

Answer **any 2** questions. (**4 each**)

21. Three newspapers P_1, P_2 and P_3 are published in a city. From a survey, it is estimated that 20% read P_1, 16% read P_2, 14% read P_3, 8% read P_1 and P_2, 5% read P_1 and P_3, 4% read P_2 and P_3 and 2% read all newspapers. What is the probability that a normally selected person :
   1) Read at least one paper
   2) Read exactly one paper and
   3) Read no newspapers.

22. If X has pdf $f(x) = \frac{1}{2}(x+1)$, $-1 < x < 1$ and zero elsewhere, find coefficient of skewness β_1 and coefficient of Kurtosis β_2.

23. Suppose that (X, Y) has joint pdf given by $f(x, y) = 6x^2y$, $0 < x < 1$, $0 < y < 1$ and zero elsewhere
   1) Verify that $\int_0^1 \int_0^1 f(x, y)\, dxdy = 1$.
   2) Find $P(X > Y)$ and $P\left(X < \frac{1}{2} / Y < \frac{1}{2}\right)$.

24. Let X, Y be random variables taking the 3 values –1, 0, 1 and having joint probability distribution given by

y \ x	–1	0	1
–1	0	0.1	0.1
0	0.2	0.2	0.2
1	0	0.1	0.1

Show that X and Y are uncorrelated. Also find conditional expectation of X/Y = 0. **(2×4=8)**

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