20U238 (Pages: 2) Name: .....

Reg.No: .....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2021

(CBCSS - UG)

(Regular/Supplementary/Improvement)

CC19U STA2 C02 - PROBABILITY THEORY

(Statistics - Complementary Course)

(2019 Admission onwards)

Time : 2.00 Hours Maximum : 60 Marks

Credit : 3

Part A (Short answer questions)

Answer ***all*** question. Each question carries 2 marks.

1. State the classical definition of probability.
2. Prove that $P(A) + P(A^c) = 1$.
3. Given $P(A) = 0.30, P(B) = 0.78$ and $P(A \cap B) = 0.16$. Find
   (i) $P(A^c \cap B^c)$ (ii) $P(A^c \cup B^c)$ (iii) $P(A \cap B^c)$.
4. State the multiplication theorem.
5. State Baye's theorem.
6. Define a continuous random variable.
7. Define marginal density function.
8. State the properties of probability density function.
9. Write any two properties of expectation.
10. If $V(X) = 2$, then obtain $V(3X - 4)$.
11. Define moment generating function.
12. Define kurtosis.

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

Answer ***all*** question. Each question carries 5 marks.

13. What is a sample space? What are events?

14. Let A and$B$ be two events such that, $P(A \cup B) = 0.8, P(A) = 0.4$ and $P(A \cap B) = 0.3$, then $P(A \cap B^c)$.

15. A problem in Statistics is given to three students A, B and C whose chances of solving it are$\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently?

16. What are the properties of probability distribution functions?

17. Given $P(x, y) = c(2x + 3y)$, where $x = 0, 1$ and $y = 1, 2$ is a joint pmf of (X, Y).Find 'c'. Also write down the values of $F(x, y)$ for $x = 0, 1$ & $y = 1, 2$

18. The joint pdf of two random variables X and Y is given by $\begin{aligned} f(x,y) &= 24x(1-y), 0 < x < y < 1 \\ &= 0, otherwise \end{aligned}$ Find the marginal pdf's of X and Y.

19. If (X, Y) has the joint pdf $f(x, y) = \frac{3}{2}x^2y, 0 < x < 1$ and $0 < y < 2$, show that X and Y are independent.

(Ceiling: 30 Marks)

Part C (Essay questions)

Answer any ***one*** question. Each question carries 10 marks.

20. A random variable X has pdf $f(x) = \frac{1}{\sqrt{2\pi}}e^{\frac{-x^2}{2}}$, $-\infty < x < \infty$. Find the density function of $Y = X^2$.

21. Let X and Y have the joint p.d.f $\begin{aligned} f(x,y) &= \frac{3}{4}x, 0 < x < y < 2 \\ &= 0, elsewhere \end{aligned}$.

Find (i) the conditional p.d.f of Y given X=x.

(ii) the conditional mean and variance of X/Y=y.

(1 × 10 = 10 Marks)

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