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Name................................

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FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2010

Statistics—Complementary Course

ST1 CO1—PROBABILITY THEORY

Time : Three Hours

Maximum : 30 Weightage

Part A

Answer **all** *the questions weight* 1 *for bunch of* 4.

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

   (a) $\frac{4}{25}$.
   (b) $\frac{3}{25}$.
   (c) $\frac{8}{25}$.
   (d) $\frac{12}{25}$.

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

   (a) 0.6.
   (b) 0.2.
   (c) 0.1.
   (d) None.

3. Let P be a probability function on $S = \{a_1, a_2, a_3\}$, then the value of $P(a_1)$ if $P(a_1) = 2P(a_2)$ and $P(a_3) = 0.7$:

   (a) $\frac{1}{10}$.
   (b) $\frac{2}{10}$.
   (c) $\frac{3}{10}$.
   (d) $\frac{4}{10}$.

4. A problem in statistics is given to three students A, B and C where chances of solving it are $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, then the probability that problem is solved.

   (a) $\frac{2}{5}$.
   (b) $\frac{3}{5}$.
   (c) $\frac{4}{5}$.
   (d) None.

Turn over

5. An event whose occurrence is inevitable is called :

   (a) Null event. (b) exhaustive event.

   (c) Equally likely event. (d) certain event.

6. Evaluate k if the following is a probability density function :

X :	0	1	2	3
$p(x)$:	$1/6$	$1/2$	$k/10$	$1/30$

   (a) 6. (b) $\frac{1}{6}$.

   (c) 3. (d) $\frac{1}{3}$.

7. If $F(x)$ denote the distribution function for the random variable X, then $F(x)$ is :

   (a) right continuous. (b) left continuous.

   (c) neither left and right continuous. (d) None of these.

8. A player is to toss three coins. He wins Rs. 10 if 3 heads appear, Rs. 5 if two heads appear, one head appears. He will lose Rs. 12 if no head appears, then the expected amount is :

   (a) Re. 1. (b) Rs. 2.

   (c) Rs. 3. (d) Rs. 4.

9. A continuous random variable X has probability density function $f(x) = 3x^2, 0 \le x$

   $p(x \le a) = p(x > a)$, then a is :

   (a) $3^{-1/2}$. (b) $2^{-1/3}$.

   (c) 2^{-3}. (d) None of these.

10. If X is a random variable, then $V(aX + b)$ is equal to :

   (a) $av(X)$. (b) $a^2v(X)$.

   (c) $av(X) + b$. (d) $a^2v(X) + b$.

11. When $\beta_2 < 3$, the distribution is :

   (a) Leptokurtic. (b) Platykurtic.

   (c) Mesokurtic. (d) None of these.

12. The second moment about mean is :

(a) $\frac{\sum(x-\bar{x})^3}{N}$.

(b) $\frac{\sum(x+\bar{x})^3}{N}$.

(c) $\frac{\sum(x-\bar{x})^2}{N}$.

(d) $\frac{\sum(x+\bar{x})^2}{N}$.

(12 × ¼ = 3 weightage)

Part B

Answer **all** *the questions, weight* 1.

13. State and classical definition of probability.
14. Define conditional probability and multiplication rule.
15. Let A and B be events with P(A) = 0.6, P(B) = 0.3 and P(A $\cap$ B) = 0.2, find $P(A^c | B^c)$.
16. State Bayes theorem.
17. Let X be the number of years before a certain kind of pump needs replacement. Let X have the probability function $f(x) = kx^3$; $x = 0, 1, 2, 3, 4$. Find k.
18. Let X (milli meters) be the thickness of washes a machine turns out. Assume that X has the density $f(x) = kx$; $0.9 < x < 1.1$ and 0 otherwise. Find k.
19. Define moment generating function. Explain its uses.
20. Explain the role of raw moments and central moments in the study of distributions.
21. Explain the term 'Kurtosis'.

(9 × 1 = 9 weightage)

Part C

Answer any **five** *questions, weight* 2.

22. State the axiomatic definition of probability. Define equally likely events and pairwise independence.
23. Let A be the event that a man will line 10 more years, and let B be the event that his wife lives 10 more years. Suppose $P(A) = \frac{1}{4}$ and $P(B) = \frac{1}{3}$. What is the probability that (a) both will be alive (b) at least one will be alive and (c) only wife will be alive.
24. A die is weighted to yield the following probability distribution :

Number	:	1	2	3	4	5	6
Probability	:	0.2	0.1	0.1	0.3	0.1	0.2

Let A = {1, 2, 3}, B = {2; 3, 5}, C = {2, 4, 6}. Find (a) P(A | B), P(B | A), (b) P(A | C), P(C | B) (c) $P(A^C)$, $P(B^C)$, $P(C^C)$.

25. Define Mathematical expectation of a random variable. Show that the mathematical of the sum of two random variable is the sum of their individual expectations and if t are independent, the mathematical expectation of their product is the product of their e

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

27. Define characteristics function. What are its advantages over moment generating fun some random variable with characteristic function $\phi(t)$ and if $\mu_r' = E(X^r)$ exists, then

$$\mu_r' = (-1)^r \left[\frac{\partial r}{\partial t^r} \phi t \right]_{t=0}.$$

(5 × 2 = 10

28. Explain the addition and multiplication theorem.

Part D

Answer any **two** *questions, weight* 4.

29. A pair of fair dice is tossed. Let X and Y be random variables such that X denotes the m the numbers and Y denotes the sum of the numbers, find E(X) and E(Y).

30. Women in city college constitute 60 percent of the freshmen, 40 percent of the s 40 percent of the juniors, and 45 percent of the seniors. The school population is 30 percen 25 percent sophomores, 25 percent juniors, and 20 percent seniors. A student from cit chosen at random.

    (a) Find the probability that the student is a woman.

    (b) If a student is a woman, what is the probability that she is a sophomore ?

31. What is skewness ? How do you test the presence of skewness in a distribution ? Th moments of a distribution about the value 2 of a variable are 1, 16, 20 and 250. Find mea and coefficient of skewness.

(2 × 4 = 8