

**Avinashilingam Institute for Home Science and Higher Education for Women  
Coimbatore-641 043**

**Bachelor's Degree Examination –November 2017**

**I Semester**

**Class : I UG  
Major: Mathematics**

**Time: 3 hours  
Max. Marks: 100**

**15BMAI01 DSE – I Mathematical Statistics – I**

**Part-A**

**10 x 1=10**

**Choose the correct answer**

1. In compatible events is otherwise called  
a. Equally likely    b. Independent    c. Mutually exclusive    d. Exhaustive
2. Axiom of certainty is  
a.  $P(S)=1$     b.  $P(A)=0$     c.  $P(\varphi)=0$     d.  $P(\varphi)=1$
3. In multiplication theorem the two events A and B are  
a. Equally likely    b. Independent    c. Dependent    d. Exhaustive
4. In conditional probability,  $P(S|S)$  is  
a. 0    b. 1    c. 2    d. -1
5. The range of the random variable is  
a.  $(-\infty, 0)$     b.  $(-1, 1)$     c.  $(0, \infty)$     d.  $(-\infty, \infty)$
6. The median of the probability density function is  
a.  $\frac{1}{2}$     b. 1    c. 0    d.  $-\frac{1}{2}$
7.  $\sum \sum P_{xy}(x, y)$  is  
a. 0    b. -1    c. 1    d.  $\infty$
8. In Joint Distribution function, the function  $F(x, y)$  is  
a. Monotonic increasing function    b. Monotonic non increasing function  
c. Monotonic decreasing function    d. Monotonic non decreasing function
9. The expected value of discrete random variable is a \_\_\_\_\_ of all possible values.  
a. Arithmetic mean    b. Weighted average    c. Harmonic mean    d. Geometric mean
10. If X and Y are independent random variable the  
a.  $Cov(X, Y)=0$     b.  $Cov(X, Y)=\infty$     c.  $Cov(X, Y)=-\infty$     d.  $Cov(X, Y)=1$

**Part B**

**5 X 6=30**

**Answer the following**

**Answer should not exceed 400 words or two pages**

11. a. What is the chance that a leaf year selected at a random will contain 53 Sundays?  
(or)  
b. Define probability function. State its axioms.
12. a. Prove that  $P(A \cap B) = P(A) \cdot P(B)$   
(or)  
b. A box contains 6 red, 4 white and 5 black balls. A person drawn 4 balls from the box at random. Find the probability that among the balls drawn there is atleast one ball of each colour.
13. a. Show that if F is distribution function of one dimensional random variable X then  $F(-\infty) = 0$ .  
(or)  
b. Prove that the geometric mean G of the distribution  $dF = 6(2-x)(x-1) dx, 1 \leq x \leq 2$  is given by  $6 \log(16G) = 19$ .
14. a. Verify the following is the distribution function.  
$$F(x) = \begin{cases} 0 & x < -a \\ \frac{1}{2(1+x)} & -a \leq x \leq a \\ \frac{1}{a} + 1 & x > a \end{cases}$$
  
b. State the properties of joint distribution function.
15. a. State and prove addition theorem of expectation.  
(or)  
b. Prove that the M.G.F of the sum of a number of independent random variables is equal to the product of their respective M.G.F.

**Part C**

**5 x 12=60**

**Answer the following**

**Answer should not exceed 800 words or four pages**

16. a. State and prove i) Addition theorem of probability ii)  $P(\bar{A}) = 1 - P(A)$ .  
(or)  
b. A card is drawn from a pack of 52 cards. Find the probability of getting a king or a heart or a red card.
17. a. If A and B are independent events then i) A and  $\bar{B}$  ii)  $\bar{A}$  and B iii)  $\bar{A}$  and  $\bar{B}$  are also independent.  
(or)  
b. A and B are two weak students of statistics and their chances of solving a problem in statistics correctly are  $1/6$  and  $1/8$  respectively. If the probability of their making a common error is  $1/525$  and they obtain the same answer, find the probability that their answer is correct.
18. a. A random variable X has the following probability function  

Value of X, x:	0	1	2	3	4	5	6	7
p(x):	0	k	2k	2k	3k	k <sup>2</sup>	2k <sup>2</sup>	7k <sup>2</sup> + k

 Find i) the value of k ii) Evaluate  $P(X < 6)$ ,  $P(X \geq 6)$  and  $P(0 < x < 5)$ , iii) if  $P(X \leq a) > 1/2$  find the minimum value of a, and iv) determine the distribution function of X.  
(or)  
b. Discuss about the measures of central tendency, dispersion, skewness of continuous probability distribution.

19. a. State and prove the distribution of the product of two random variables.  
(or)

b. The joint probability density of two random variables X and Y given by  $P(X=0, Y=1)=1/3$ ,  
 $P(X=1, Y=-1)=1/3$  and  $P(X=1, Y=1)=1/3$ .  
Find i) Marginal distribution of X and Y  
ii) The conditional probability distribution of X given  $Y=1$ .

20. a. i) State and prove multiplication theorem of expectation.  
ii) Prove that  $\text{Cov}(X, Y) = E(XY) - E(X)E(Y)$ .  
(or)

b. The probability density function of the random variable X follows the probability law  
$$p(x) = \frac{1}{2\theta} \exp\left(-\frac{|x - \theta|}{\theta}\right), -\infty < x < \infty$$
  
Find M.G.F of X. Hence or otherwise find  $E(X)$  and  $V(X)$ .

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