Mid-Semester Examination, October - 2018
Probability & Statistics (MTH - 2002)

Semester: 3rd Semester | Branch: CSE, CSIT

Full mark: 30 | Time: 2 Hours

Subject Learning Outcome	*Taxonomy Level	Ques. No.	Marks
Apply probability axioms to compute probability and conditional probability	L2,L3,L4, L4,L4	1(b,c) 2(a,b)	2*4
Define random variables and compute probability distributions, joint & marginal distribution	L4,L4,L4, L4, L4	3(a,b,c) 4(a)	2*4
Compute expectation of random variables	L5,L4,	5(a,b,c)	2*3
Discuss discrete probability distribution viz: Binomial, Hypergeometric & negative Binomial	L4, L4	4(b,c)	2*2
Estimate the variance	L4	1(a), 2(c)	2*2

*Bloom's taxonomy levels: Knowledge (L1), Comprehension (L2), Application (L3), Analysis (L4), Evaluation (L5).

Answer all questions. Each question carries equal mark.

1.(a) Calculate the sample Mean and variance of the sample given below **2**

10, 12, 11, 10, 11, 12, 9, 8   10·375 , 1·982

(b) The probability that an American industry will locate in Shanghai is 0.7, the probability that it will locate in Beijing is 0.4 and the probability that it will locate in either Shanghai or Beijing or both is 0.8. Compute the probability that the industry will locate **2**

$P(S)+P(B)-P(S\cup B)=0\cdot3$

(i) In both cities.   0·3

(ii) In neither city.   0·2

$1-P(S\cup B)=$

(c) In a certain assembly plant, three machines B_1, B_2 *and* B_3 make 30%, 20% and 50%, respectively, of the products. It is known from past experience that 2%, 3% and 3% of the products made by each machine, respectively, are defective. Now, suppose that a finished product is randomly selected and found to be defective, Find the probability that is produced in machine B_1. 2

$\frac{P(B_1)\,P(D|B_1)}{P(D)}$ 0.0245 0.02

2.(a) The waiting time, in hours, between successive speeders spotted by a radar unit is a continuous random variable with cumulative distribution function 2

$$F(x)=\begin{cases}0, & x<0\\ 1-e^{-8x}, & x\ge 0\end{cases}$$

0.798

(i) Compute probability density function of X.

(ii) Find the probability of waiting less than 12 minutes between successive speeders

(b) For a laboratory assignment, if the equipment is working, the density function of the observed outcome X is 2

$$f(x)=\begin{cases}2(1-x), & 0<x<1\\ 0, & \textit{otherwise}\end{cases}$$

$E(X)=1/3$ $\frac{1}{18}=0.0555$ 0.2357

Compute the mean and variance of X.

(c) A random variable X has a mean $\mu=10$ and a variance $\sigma^2=4$. Using Chebyshev's theorem, find 2

$P(|X-10|\ge 3)$; $\le 4/9$

3.(a) A traffic control engineer reports that 75% of the vehicles passing through a checkpoint are from within the state. Compute the probability that fewer than 4 of the next 9 vehicles are from out of state? 2

0.3759

(b) The probabilities are 0.4, 0.2, 0.3 and 0.1 respectively, that a delegate to a certain convention arrived by air, bus, automobile, or train. Compute the probability that among 9 delegates randomly selected at this convention, 3 arrived by air, 3 arrived by bus, 1 arrived by automobile, and 2 arrived by train? 2

7.4144×10^{-3}

(c) Evaluate the value of 'k' for which f(x) given below will be a valid Probability function 2

$f(x) = kx^2,\ x = 0,1,2,3$

4 (a) Suppose X and Y have the following joint probability function 2

f(x,y)		X		
		0	1	2
y	1	0.1	0.1	0.2
	3	0.2	0.1	0.15
	5	0.15	0	0

Estimate $P(Y \leq 3 \mid X = 1)$ $= f(1,1) + f(1,3) + \cancel{f(1,5)} = .45$

(b) Let X and Y denote the lengths of life, in years, of two components in an electronic system. If the joint density function of these variables is

$$f(x,y) = \begin{cases} e^{-(x+y)}, & x > 0, y > 0 \\ 0, & elsewhere \end{cases}$$

Compute marginal distribution of X and Y

(c) A certain area of the eastern Odisha, on average, hit by 6 cyclones a year. Using Poisson distribution, find the probability that in a given year that area will be hit by. 2

(a) Fewer than 4 cyclones. 0.2851

(b) Anywhere from 6 to 8 cyclones. 0.2469

5.(a) From a certain manufacturing process, It is known that on the average 1 in every 10 items is defective. Calculate the Probability that the fifth item inspected is the 2nd defective item found. 2

(b) The finished inside diameter of a piston ring is normally distributed with a mean of 10 centimeters and a standard deviation of 0.03 centimeter, then what percentage of rings will have inside diameters exceeding 10.075 centimeters? 2

(c) The life, in years, of a certain type of electrical switch has an exponential distribution with an average life $\beta = 2$. If 100 of these switches are installed in different systems, what is the probability that at most 30 fail during the first year?

End of Questions