

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
Work Integrated Learning Programmes Division
Cluster Programme- M.Tech in Data Science and Engineering
I Semester , 2022 – 23(January,2023)
Mid semester Examination (Regular)

Q1. a).Consider the following data from the industry. Let D be the set of software developers in a company .Some subsets of D and some of probability that a random employee will belong to the set are represented below. Find the missing term in the table with justification.[3M]

Try to identify inconsistencies also (if exists and validate them).

Set in words	Symbol	Probability
All software developers	D	
All software testing engineers	T	
All software developers and/or software testing engineers		0.25
All software developers who are not software testing Engineers		0.05
All software testing engineers who are not software Developers		0.10
All software developers and software testing engineers		

b).A biased coin with probability of falling as heads 0.6 is tossed 20 times. Obtain the prob of getting 5 heads using Binomial , Poisson assumptions and compare.[3M]

Q2.a) Consider the following data.

[3M]

A: the event that a patient selected is with high B.P

B:the event that a patient selected is diabetic

C:the event that a patient selected is with cancer

Events	A	B	C	A andB	BandC	A andC	(A and BandC)
Probability	0.35	0.40	0.45	0.22	0.25	0.22	0.15

i).If a patient is selected at random, what is the probability that he suffering from at least one of these health issues?

ii).What is the probability that the patient selected is with B.P given that he is with either of the remaining two diseases?

iii).What is the probability that the patient is diabetic given that he is suffering from at least one of the diseases mentioned?

b).A manufacturer has four machine operators A, BC and D. The first operator A produce 1% defective items, whereas the other two operators B, C and D produce 5%, 6% and 7% defective items respectively. A is on the job for 30% of the time, B is on the job for 30% of the time is on the job for 20% of the time and D is on the job for 20% of the time. A defective item is produced, what is the probability that it is produced by A?

Suppose if B spends 15% of the time (instead of 30% as planned) on the job then what is the probability that the defective item is produced by him? [3M]

3. a).A manufacturer knows that on an average of 2% of the electric toasters that hemakes will require repairs within 90 days after they are sold. Use the normal approximation to the binomial distribution to determine the probability that among 1200 of these toasters at least 30 will require repairs within the first 90 days after they are sold.[3M]

b). If the probability density function of a random variable X is given by

$$f(x) = k(1-x^2) \text{ for } 0 \leq x \leq 2$$

Find (I) the value of k

(ii) Probability $P(0.5 \leq X \leq 2)$

(iii) Probability at $x=2$.

Q4.a). Suppose the random variable X and Y have joint density function defined by [3M]

$$f(x,y) = \begin{cases} k(2x+y), & 2 < x < 5, 0 < y < 4 \\ 0 & \text{otherwise} \end{cases}$$

Find (i) k (ii) $P(X > 2, Y > 3)$ (iii) $P(X > 4)$ (iv) $P((X+Y) < 3)$

b). The joint probability distribution of two random variables X and Y is given by [3M]

p(x,y)	X		
y		2	4
	1	0.1	0.15
	3	0.2	0.3
	5	0.1	0.15

- i) Evaluate the marginal distributions of X and Y
- ii) Find $P(Y=3/X=4)$
- iii) Are they independent random variables?

Q5. a). Out of 1000 families with 5 children each how many families would be expected to have (i) 2 boys (ii) at least 1 boy (iii) at most 3 girls (iv) children of both sexes. Assuming equal probabilities for boys and girls [3M]

b). A sample of 100 battery cells tested to find the length of life produced. Assuming the data to be normally distributed with mean 12hrs and standard deviation 3hrs, what percentage of battery cells are expected to have life length of life [3M]

- i). More than 15 hrs
- ii) Less than 6hrs
- iii) between 10 and 14hrs

