| **ML\_ASSISMENT\_11** |
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1. **Given X be a discrete random variable with the following PMF**

**PX(x)=** {**0.1 for x=0.2**

**0.2 for x=0.4**

**0.2 for x=0.5**

**0.3 for x=0.8**

**0.20 for x=1**

**0 otherwise**

1. **Find the range RX of the random variable X.**

**sol:** Rx={0.2,0.4,0.5,0.8,1}

1. **Find P(X ≤ 0.5)**

**sol:**The event X≤0.5 can happen only if X is 0.2,0.4,0.5 . Thus

P(X≤0.5)=P(X∈{0.2,0.4,0.5})

=P(X=0.2)+P(X=0.4)+P(X=0.5)

=PX(0.2)+PX(0.4)+PX(0.5)

=0.1+0.2+0.2

=0.5

1. **Find P(0.25<X<0.75)**

**sol:**Similarly, we have

P(0.25<X<0.75)

=P(X∈{0.4,0.5})

=P(X=0.4)+P(X=0.5)

=PX(0.4)+PX(0.5)

=0.2+0.2

=0.4

1. **P(X = 0.2|X<0.6)**

**Sol:** Using the formulaP(A|B)=P(A∩B)/P(B)

We have , P(X=0.2|X<0.6)

P(A∩B)= 0.2 and P(B)= 0.6

=P((X=0.2)/ P(X<0.6)

=PX(0.2)/PX(0.2)+PX(0.4)+PX(0.5)

=0.1/0.1+0.2+0.2

=>1/5 ~=0.2

1. **Two equal and fair dice are rolled, and we observed two numbers X and Y.**
2. **Find RX, RY, and the PMFs of X and Y**

**Sol:**

We have RX=RY={1,2,3,4,5,6}

Assuming the dice are fair, all values are equally likely so

PX(k)=belongs into the range ⅙ and 0

In which { k=1,2,3,4,5,6 and otherwise

Similarly goes for PY(K).

1. **Find P(X = 2,Y = 6)**

**Sol:** Since X and Y are independent, Probability of getting x=2 , x=6 is 1/36

1. **Find P(X>3|Y = 2)**

**Sol:** Since X and Y are independent, knowing the value of Y does not impact the probabilities for X,P(X>3|Y=2)

=P(X>3)

=PX(4)+PX(5)+PX(6)

=⅙ + ⅙ + ⅙

=0.5

1. **If Z = X + Y. Find the range and PMF of Z**

**Sol: z{**2,3…12**}**  as combination can not be >2 so is from 2 to 12

* since z is total number of outcome of both dice as x and y are independent, so x=⅙ and y=⅙

z(P1)=1/36

* Similarly prob of getting combine total 3 is (1+2) or (2+1)

z(P2)=1/36 + 1/36

z(P2)=1/18

Similarly the range is z(P3)=3/36 …………………….z(P12)= 1/36

**find P(X = 4|Z = 8).**

**Sol:**

Z depend on x Using P(A|B)=P(A∩B)/P(B)

=P(X=4,Z=8)/P(Z=8)

=P(X=4,Y=4)/P(Z=8)

=⅙⋅⅙ divided by p(z=8) ie. 5/36

=>1/36/5/36

=⅕

**3. In an exam, there were 20 multiple-choice questions. Each question had 44 possible options. A student knew the answer to 10 questions, but the other 10 questions were unknown to him, and he chose answers randomly. If the student X's score is equal to the total number of correct answers, then find out the PMF of X. What is P(X>15)?**

Sol:

Let's assume the random variable Y as the number of your correct answers to the 10 questions you answer randomly. Then our total score will be X=Y+10.

Let's find the PMF of Y For each question our success probability is ¼ . ie (out of four one option is correct)Hence, we perform 10 independent Bernoulli(1/4) trials and Y is the number of successes.

Thus, we conclude Y∼Binomial(10,¼), so

we need to find the PMF of X=Y+10 RX={10,11,12,...,20}

The probability mass function (PMF) of a binomial random variable X with parameters n and p is given by:

**P(X=K) = (xy)\*Py\*(1-P)x-y**

We can write

PX(10) and PY(0)

=(100)(1/4)0(3/4)10−0

=(3/4)10

PX(10) then y=0

…………………….px(20) then y=10

4. The number of students arriving at a college between a time interval is a Poisson random variable. On average, 10 students arrive per hour. Let Y be the number of students arriving from 10 am to 11:30 am. What is P(10<Y≤15)?

5.Two independent random variables, X and Y,are given such that X~Poisson(α) and Y~Poisson(β). State a new random variable as Z = X + Y. Find out the PMF of Z.