**Lab 03-CSE7315c- Probability Distributions**

**1)**.Let us suppose, you have tossed two two-sided fair coins.

1. Compute the PMF for heads in this experiment
2. Compute Expectation of heads

**ANSWER:-**

Sample space ={ HH, HT, TH, TT}

Therfore we consider PMF only for Heads.

X(no. of Heads) p(X) F(x)

1. 1/4 1/4

1 2/4 3/4

2 1/4 1

PROBABILITY MASS FUNCTION FOR HEADS

|  |  |  |  |
| --- | --- | --- | --- |
| x | 0 | 1 | 2 |
| P(x) | 1/4 | 2/4 | 1/4 |

Expected value

E(x) = Σxi.p(x) = 1(2/4) + 2(1/4) = **1**

**Expected value = 1**

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**2).** **For a given probability density function, calculate**



1. i)  P(X = 2)
2. ii)  P(X <= 4)
3. iii)  P(X < 1)

iv) P(2<=X<=3)

**ANSWER:-**

1. P( X = 2) = 3(x)^-4

= 3(2)^-4

**P(X = 2) = 0.1875**

1. P( X ≤ 4) = ∫ 3x-4 .dx

=1 ∫ 43x-4

= 3(x)-4+1/-4+1

**P( X ≤ 4) = 0.9843**

1. P (x<1) = ?

(From given function it is 0)

**P (x<1) = 0**

1. P (2 <= x >= 3) = ?

= ∫ 3x-4 .dx

= 2 ∫ 33x-4 / -4+1

= 3(3)^-3/-3+ 3(2)^-3/-3(upper limit – lower limit)

= -(3)^-3 + (2)^-3

= 0.087

**P (2 <= x >= 3) = 0.087**

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3). In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be must be dropped to give a 99% chance or better of completely destroying the target?

**ANSWER:-**

Probability of hitting = p = 0.5

Probability of not hitting = q = 0.5

Probability of destroying a target = 0.99

i.e

p(x >= 2) = 0.99

we know that p = q-1.

1 – p (x < 2) = 0.99 (from above)

p (x < 2) = 0.01

i.e

p( x = 0) + p( x = 1) = 0.01

nC0 \* (p)0 \* (1-p)n + nC1 \* (p)1 \*(1-p)n-1 =0.01

pn + n\* pn = 0.01

pn[ 1+n ] = 0.01

we know p = ½

(1/2)n \*[1+n] = 0.01

by solving with trail and error method we get

**n = 10**

**i.e**

**10 bombs must be dropped to completely destroy the target.**

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4). Customers arrive at a bus station at the rate of 5 per minute following Poisson distribution. What is the probability of 3 arrivals in a one-minute interval?

**ANSWER:-**

X = mean (x)

P(x = k) = (e-λ \* λk ) / k !

P (x = 3) = (e-5 \* 53 ) / 3 !

**P(x= 3 ) = 0.14**

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5. A radioactive source emits on the average 2.5 particles per second. Calculate the probability that 3 or more particles will be emitted in an interval of 4 seconds.

**ANSWER:-**

λ = occurring /unit time = 2.5 / sec

μ = λt = 2.5 \* 4 = 10

P(x=> 3) = 1 – P(x<=2)

= 1- P(x=0) – P(x=1) – P(x=2)

= 1- (2.718^-10) – (2.718^ -10 \* 10) – ((2.718^ -10 \* 100)/2))

= 1- (0.000045 – 0.00045 – 0.0022)

= 1 – (-0.000408 – 0.0022)

= 1 – ( -0.0026)

**p (x => 3 )= 0.9974**

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**6.** A representative from the Coca-colamarketing division randomly selects people on a random street of Mumbai city, until he finds a person who purchased a Coca-cola in last one month. Let *p*, the probability that he succeeds in finding such a person, equal 0.20. And, let *X* denotes the number of people he selects until he finds his first success.

i) What is the probability that the marketing representative must select 4 people to find one who purchased a Coca-cola in the last one month?

**ANSWER:-**

P = 0.20

x = geo (0.2)

X = q^3 (0.2) q = 1-p

X= (0.8)^3 \* (0.2)

X = 0.512 \* 0.2

X = 0.1024

**X = 10.24%**

ii) What is the probability that the marketing representative must select more than 6 people before he finds the one who purchased a Coca-cola in the last one month?

P(x>=6)

1-P(x<=5)

> 1- pgeom(5,0.2) = [1] 0.262144

**= 26.21%**

iii) How many people should we expect the marketing representative needs to select before he finds one who purchased a Coca-cola in the last one month?

E(x) = 1 / P

E(x) = 1/ 0.2 = 5

**E(x) = 5**

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7). Suppose you have a small wada-pav shop and customer arrive at an average rate of 12 per hour. Find the probability that a customer will arrive in the next 5 minutes given that you have already waited 10 minutes for a customer.

**ANSWER:-**

λ = 12 / 16

λ = 1 / 5

p(x<=15 | x>10) = 1- p(x>15) / p(x>10)

p(x<=15 | x>10) = 1- (1- pexp(15,1/5)) / (1- pexp(10,1/5)

The probability that a customer will arrive in the next 5 minutes given that you have already waited 10 minutes for a customer

**p(x<=15 | x>10) = 0.6321**

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8. In a distribution exactly normal, 10.03% of the items are under 25kilogram weight and 89.97% of the items are under 70 kilogram weight. What are the mean and standard deviation of the distribution?

**ANSWER:-**

Probability of the items under the weight of 25kg=P(X≤25)=0.1003

Probability of the items under the weight of 70kg=P(X≤70)=0.8997

Probability of the items whose weight is above 70kg=P(X>70)=0.1003

Z = (x - µ)/var

P(Z ≤ -Z1) = P((x-µ)/var ≤ -Z1) = 0.1003

= qnorm (0.1003)

= -1.27

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9. A college basketball team has a shortage of one team member and the coach wants to recruit a player. To be selected for training the minimum height for recruitment is 72 inches. The average height of the students is 67.2 inches with a variance of 29.34. What is the probability that the coach finds a player from that college?

**ANSWER:-**

Given- µ = 67.2, x=72, var = 29.34

Sd = 5.4166

P(X>72) = P((x-µ)/sd > (72-67.2)/5.4166 )

= P(Z > 0.887 )

= 1- pnorm(0.887)

=0.1875

The probability that the coach finds a player from that college is 0.1875.

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