CENG 222

Statistical Methods for Computer Engineering

Spring '2016-2017

Assignment 2

Deadline: March 26, 23:59

Submission: via COW

Student Information

Full Name : Berkant Bayraktar
Id Number : 2098796

Answer 3.15

a)

1 - P(X=0,Y=0) = 1 - 0.52 = 0.48

b)

Marginal pmf of X	
x	P(X = x)
0	0.72
1	0.23
2	0.05

Marginal pmf of Y	
y	P(Y = y)
0	0.76
1	0.17
2	0.07

P(X=0,Y=0) = 0.52
P(X=0).P(Y=0) = (0.72).(0.76) = 0.5472
Since P(X=0,Y=0) $\neq$ P(X=0) $\cdot$ P(Y=0) , X and Y are not independent.

Answer 3.32

Let X be number of crashed computers during a severe thunderstorm.It is the number of successes in 4000 Bernoulli trials,thus X is Binomial with $\boldsymbol{n}$ = 4,000 and $\boldsymbol{p}$ = 1/800.Poisson approximation can be applied to X .

$\lambda = \boldsymbol{n}.\boldsymbol{p}$

a)

P(X<10) = ***F(9)*** = 0.968

b)

P(X=10) = ***F(10) -F(9)*** = (0.986) - (0.968) = 0.018

Answer 3.35

Let X be the number of traffic accidents and T be the event "thunderstorm".During the thunderstorm,

$$\boldsymbol{P(X{=}7 \mid T)} = \frac{(e^{-10})(10^7)}{7!} = 0.09 \text{ ,where } \lambda = 10$$

When there is no thunderstorm,

$$\boldsymbol{P(X{=}7 \mid T^C)} = \frac{(e^{-4})(4^7)}{7!} = 0.06 \text{ ,where } \lambda = 4$$

By using Bayes Rule,

$$\boldsymbol{P(T \mid X{=}7)} = \frac{\boldsymbol{P(X{=}7 \mid T)P(T)}}{\boldsymbol{P(X{=}7 \mid T)P(T)}+\boldsymbol{P(X{=}7 \mid T^C)P(T^C)}} = \frac{(0.09)(0.6)}{(0.09)(0.6)+(0.06)(1-0.6)} = 0.6923$$

Answer 4.4

a)

We know that $\int\limits_{-\infty}^{\infty} f(x)\mathrm{d}x = 1$

$$\int_0^{10} (K - \frac{x}{50})\mathrm{d}x = Kx - \frac{(x^2)}{(2)(50)}\Bigg|_0^{10} = 10K - 1$$

Since 10K - 1 = 1 , we get K = 0.2

b)

We need to find P(X < 5) which is equal to $\int_0^5 f(x)\mathrm{d}x$

$$\int_0^5 (0.2 - \frac{x}{50})\mathrm{d}x = (0.2)x - \frac{(x^2)}{(2)(50)}\Bigg|_0^5 = 1 - 0.25 = 0.75$$

c)

$$\mathrm{E(X)} = \int x f(x) dx = \int_0^{10} x(0.2 - \frac{x}{50})dx = \left[\frac{(0.2)(x^2)}{(2)} - \frac{(x^3)}{(3)(50)}\right]\Bigg|_0^{10}$$

$$= 10 - \frac{20}{3} = 3.3333 \text{ years}$$

Answer 4.10

Let A be the event that the first specialist is working on the order and W be the event that the order is not ready in 30 minutes.

$$\boldsymbol{P(A|\,W)} = \frac{\boldsymbol{P(A \cap W)}}{\boldsymbol{P(W)}}$$

The event W can occur in two ways.
1- The first scientist got the order, but it is not ready yet.
2- The second scientist got the order, but it is not ready yet.

$$\boldsymbol{P(W)} = 0.6 \times \mathrm{e}^{\frac{-3}{2}} + 0.4 \times \mathrm{e}^{-1}$$

$$\boldsymbol{P(A|\,W)} = \frac{0.6\times \mathrm{e}^{\frac{-3}{2}}}{0.6\times \mathrm{e}^{\frac{-3}{2}} + 0.4\times \mathrm{e}^{-1}} = 0.476$$