CENG 222

Statistical Methods for Computer Engineering

Spring '2016-2017

Assignment 2

Deadline: March 26, 23:59
Submission: via COW

Student Information

Full Name : Onur Can TIRTIR
Id Number : 2099380

Answer 3.15

a)

Since we want to find the probability of at least one hardware failure, we need to subtract the probability that 0 hardware failure from 1. Then the answer is $1 - 0.52 = 0.48$.

b)

We need to find one contradiction to show that they are independent.
We can find $P(y = 0) = \sum_{x=0}^{2} P(x, y = 0) = 0.76$, $P(x = 0) = \sum_{y=0}^{2} P(x = 0, y) = 0.72$.
If these $P(x = 0)$ and $P(y = 0)$ are independent then $P(x = 0)P(y = 0) = P(x = 0, y = 0)$. But $0.5472 \neq 0.52$. Hence they are dependent.

Answer 3.32

X is to be the number of crashed computers. We want to compute the number of *successes(a computer crashed)* within 4000 computers, which are our trials($n = 4000$). Here the probability of success is $p = 1/800$. Hence $\lambda = np = 5$. Since n is large and p is small then we have a binomial distribution.

a)

$P(x < 10) = F(9) = 0.968$ from the table A3 in book.

b)

$P(x = 10) = F(10) - F(9) = 0.986 - 0.968 = 0.018$ from the table A3 in book.

Answer 3.35

Let X is to be the number of traffic accidents occured yesterday and T be the event(thunderstorm). By Bayes Rule:

$$\begin{aligned}
P(T|X=7) &= \frac{P(X=7|T)P(T)}{P(X=7)} \\
&= \frac{P(X=7|T)P(T)}{P(X=7|T)P(T) + P(X=7|\overline{T})P(\overline{T})} \\
&= \frac{(F_{\lambda=10}(7) - F_{\lambda=10}(6))0.6}{(F_{\lambda=10}(7) - F_{\lambda=10}(6))0.6 + (F_{\lambda=4}(7) - F_{\lambda=4}(6))0.4} \\
&= \frac{(0.220 - 0.130)0.6}{(0.220 - 0.130)0.6 + (0.949 - 0.889)0.4} \\
&= 0.6923076
\end{aligned}$$

Answer 4.4

a)

$$\begin{aligned}
\int_{-\infty}^{+\infty} K - \frac{x}{50} &= \int_{0}^{10} K - \frac{x}{50} + 0 && \text{Since in other areas f(x)=0} \\
&= (Kx - \frac{x^2}{100})|_0^{10} \\
&= (10K - \frac{100}{100}) - 0 \\
&= 10K - 1 = 1
\end{aligned}$$

Hence $10K = 2$ then $K = 0.2$.

b)

$$\begin{aligned}\int_0^5 0.2 - \frac{x}{50} &= (0.2x - \frac{x^2}{100})|_0^5 \\ &= (1 - \frac{5^2}{100}) - 0 \\ &= (1 - \frac{1}{4}) \\ &= \frac{3}{4}\end{aligned}$$

c)

$E(X) = \int_{-\infty}^{+\infty} xf(x)$

$$\begin{aligned}\int_{-\infty}^{+\infty} x(0.2 - \frac{x}{50}) &= \int_{-\infty}^{+\infty} (0.2x - x\frac{x}{50}) \\ &= \int_0^{10} (0.2x - x\frac{x}{50}) && \text{Since in other areas f(x)=0} \\ &= (0.1x^2 - \frac{x^3}{150})|_0^{10} \\ &= (0.1 * 100 - \frac{100}{15}) - 0 \\ &= (10 - \frac{20}{3}) \\ &= \frac{10}{3}\end{aligned}$$

Answer 4.10

W is to be the event that the orders is still not ready, in 30th minute. That means W is the event that the order given takes more than 30 minutes. Let S_1 be the event that the order is taken by the first specialist. Let S_2 be the event that the order is taken by the second specialist. Note that S_1 and S_2 are disjoint events. By Bayes Rule and Total Probability:

$$
\begin{aligned}
P(S_1|W) &= \frac{P(W|S_1)P(S_1)}{P(W|S_1)P(S_1) + P(W|S_2)P(S_2)} \\
&= \frac{e^{-\frac{3}{2}}0.6}{e^{-\frac{3}{2}}0.6 + e^{-1}0.4} && \text{By the formula for } P(X) \text{ in an exponential distribution} \\
&= 0.47638386222
\end{aligned}
$$