CENG 222

Statistical Methods for Computer Engineering

Spring '2017-2018

Take Home Exam 1

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Student Information

Full Name : Adil Kaan Akan
Id Number : 2171155

Answer 3.8

There four possibilities each of them has same probability which is 1/4.

$$\text{E(x)} = \sum_{x=0}^{3} x * P(X = x) = 0 * 1/4 + 1 * 1/4 + 2 * 1/4 + 3 * /1/4 = 1.5$$

$$\text{Var(x)} = E(x^2) - (E(x))^2 = 1 * 1/4 + 2^2 * 1/4 + 3^2 * 1/4 - (3/2)^2 = 1.25$$

Answer 3.15

a.

We can get the answer by calculating the possibility of no errors in each lab and substracting it from 1.

$P(atleast1failure) = 1 - P(0failuresineachlab) = 1 - P(0,0) = 1 - 0.52 = 0.48$

b.

For being independent events, for every x and y, $P_{XY}(x, y) = P_X(x) * P_Y(y)$ must be true. Since we can show a counterexample for it which is $P_{XY}(0, 0) = 0.52 \neq P_X(0) * P_Y(0) = (0.52 + 0.14 +$

$0.06) * (0.52 + 0.20 + 0.04) = 0.55$. So, they are not independent, they are dependent events.

Answer 3.19

a.

$E(X) = \sum_x x * P(X = x) = 2 * 0.5 + (-2) * 0.5 = 0$
$Var(X) = E(x^2) - (E(x))^2 = 200^2 * 0.5 + (-200)^2 * 0.5 = 40000$

b.

$E(Y) = \sum_y y * P(Y = y) = 4 * 0.2 + (-1) * 0.8 = 0$
$Var(Y) = E(y^2) - (E(y))^2 = 400^2 * 0.2 + (-100)^2 * 0.8$

c.

Define $T = 50 * X + 50 * Y$
$E(T) = E(50 * X) + E(50 * Y) = 50 * E(X) + 50 * E(Y) = 50 * 0 + 50 * 0 = 0$
$Var(T) = E(t^2) - (E(t))^2 = 100^2 * 0.5 + 100^2 * 0.5 + 200^2 * 0.2 + 50^2 * 0.8 = 20000$

Answer 3.29

Define X as a possion distribution with $\lambda = 0.1$ for the possibility of the low risk drivers to crash.
Define Y as possion distribution with $\lambda = 1$ for the possibility of the higher risk drivers to crash.
Probability of the low risk drivers is P(Low risk drivers) = 0.8
Probability of the high risk drivers is P(High risk drivers) = 0.2
P(No crashes — Low risk drivers) = $(\lambda^0/0!) * e^{-\lambda} = e^{-0.1}$
P(No crashes — High risk drivers) = $(\lambda^0/0!) * e^{-\lambda} = e^{-1}$

P(High Risk drivers — No crashes) =
(P(No crashes — High risk drivers)*P(High risk drivers))/(P(No crashes — High risk drivers)*P(High risk drivers) + P(No crashes — Low risk drivers) * P(Low risk drivers))

$= \frac{0.2 * e^{-1}}{0.2 * e^{-1} + 0.8 * e^{-0.1}} = 0.0922$