Stat 330
Homework 6

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March 6, 2020

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1)

(a)

X \ Y	0	1	2	$p_x(x)$
0	0.3	0.1	0.1	0.5
1	0.2	0.1	0	0.3
2	0.1	0.1	0	0.2
$p_y(y)$	0.6	0.3	0.1	1

(b) E(X) = (0)(0.5) + (1)(0.3) + (2)(0.2) = 0.7
E(Y) = (0)(0.6) + (1)(0.3) + (2)(0.1) = 0.5

E(X^2) = $(0)^2$(0.5) + $(1)^2$(0.3) + $(2)^2$(0.2) = 1.1
E(Y^2) = $(0)^2$(0.5) + $(1)^2$(0.3) + $(2)^2$(0.2) = 0.7

Var(X) = E(X^2) - $|E(X)|^2$ = 1.1 - 0.7^2 = 0.61
Var(Y) = E(Y^2) - $|E(Y)|^2$ = 0.7 - 0.5^2 = 0.45

(c) E(XY) = (0)(0)(0.3) + (1)(0)(0.1) + (2)(0)(0.1) +
(0)(1)(0.2) + (1)(1)(0.1) + (2)(1)(0) +
(0)(2)(0.1) + (1)(2)(0.1) + (2)(2)(0) = 0.3

Cov(X, Y) = E(XY) - E(X)E(Y) = 0.3 - (0.7)(0.5) = -0.05

Corr(X, Y) = $\frac{Cov(X,Y)}{\sqrt{Var(X)*Var(Y)}} = \frac{-0.05}{\sqrt{0.61*0.45}}$ = -0.095

(d) Covariance != 0, and $p_{x,y}(1,0)$!= $p_x(1)$ * $p_y(0)$.
Therefore the two days are not independent.

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2)

(a) P(X=Y) = $p_{x,y}(0,0)$ + $p_{x,y}(1,1)$ + $p_{x,y}(2,2)$ = 0.3 + 0.1 + 0 = 0.4

(b) P(X<Y) = $p_{x,y}(0,1)$ + $p_{x,y}(0,2)$ + $p_{x,y}(1,2)$ = 0.1 + 0.1 + 0 = 0.2

(c) P(X>Y) = $p_{x,y}(1,0)$ + $p_{x,y}(2,0)$ + $p_{x,y}(2,1)$ = 0.2 + 0.1 + 0.1 = 0.4

(d) $p_{x,y}(0,0) = 0.3$

(e) $p_{x,y}(1,2) = 0$

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3)

(a) Hmmmmm

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4)

(a)

X \ Y	2	3	4	$p_x(x)$
1	0.083	0.167	0	0.25
2	0.167	0	0.333	0.5
3	0.083	0.167	0	0.25
$p_y(y)$	0.333	0.333	0.333	1

(b) Two variables are independent if, for all values of X and Y:
P(x | y) = P(x)
P(x ∩ y) = P(x)*P(y)
The variables are dependent, as P(x ∩ y) for (2, 3) = 0, but P(X=2)*P(Y=3) = .167
This violates the second rule of independence.

(c)

A \ B	2	3	4	$p_x(x)$
1	0.083	0.083	0.083	0.25
2	0.167	0.167	0.167	0.5
3	0.083	0.083	0.083	0.25
$p_y(y)$	0.333	0.333	0.333	1

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5)

(a) 3 goals in the next 5 games $\Rightarrow \lambda = 1.1*5 = 5.5$
$P(X>3) = 1 - P(X\leq 3)$. Using CDF table, $P(X\leq 3) = 0.2017$
$P(X>3) = 1 - 0.2017 = .7983$

(b) As the team averages 1.1 goals per game, the probability of $P(Y=0) = .3329$
Thus, $Y \sim Bin(5, .3329) \Rightarrow P(Y<2) = P(Y<0) + P(Y<1) =$
$\binom{5}{0}(0.3329)^0(1\text{-}0.3329)^{5-0} + \binom{5}{1}(0.3329)^1(1\text{-}0.3329)^{5-1} = .1321 + .3296 = .4618$

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6)

(a) $X \sim Pois(1)$. $\Rightarrow P(\text{High risk} \mid 0 \text{ accidents}) = P(X=0) = e^{-}1 = .3679$