Stat 400 Homework 3

Spring 2021 (Yu)

Due: ***Tues Feb 23 @ 11:59pm***

Exercise 1

While wandering around the halls of North Shore High School after hours, Regina George encounters lots of enemies. Suppose enemies appear one-at-a-time. You may assume that these encounters are independent and that these are there are only 4 types of enemies she may run into:

Enemy	Probability
Freshman	0.5
Sophomore	0.2
Junior	0.2
Senior	0.1

a) Suppose she encounters 10 enemies. What is the probability that at least 1 is a Junior? (0.4 pt)

b) What is the probability that the first 8 enemies she encounters are all Freshmen? (0.4 pt)

c) Suppose she encounters 10 enemies. What is the probability that more than 8 are Freshmen? (0.4 pt)

d) What is the probability that she sees her first Senior **after** her tenth encounter? (0.4 pt)

e) What is the probability that she sees her third Senior **on** (exactly) her thirtieth encounter? (0.4 pt)

f) What is the variance of the number of Sophomore she sees in her first 20 encounters? (0.5 pt)

g) What is the variance of the number of trials required to find her first Junior? (0.5 pt)

Exercise 2 (Use R to find the following. Show your commands)

(Use the same probabilities shown above for #1) **Must use R** to get credit on these!

a) Find the probability that it takes fewer than 8 trials to find the first Sophomore. (0.5 pt)

b) Suppose she encounters 100 enemies. What is the probability that fewer than 18 are a Juniors? (0.5 pt)

c) Suppose she encounters 100 enemies. What is the probability that at least 65 are Freshmen? (0.5 pt)

d) What is the probability that she sees her 4th Junior **by** (including) her twentieth encounter? (0.5 pt)

Exercise 3

In a football league, suppose a particular team's offensive line allows their quarterback to be sacked on 40% of their plays if they are not playing against the Bucs. On any given night, there is a 10% chance that they are playing against the Bucs, in which case the team will allow their quarterback to be sacked on 90% of the plays. *Note: Assume that a play either does or does not result in sack. You can only be sacked once in a play.*

a) Suppose your roommate saw a randomly selected highlight reel (play) where the quarterback got sacked. Based on this information, what is the probability that this team was playing against the Bucs? (1 pt)

b) Assume that the result of every play is independent. Out of the first 10 plays, your roommate says that the quarterback got sacked 7 times. What is the probability that this team was playing against the Bucs? (1.5 pt)

Exercise 4

While taking Chloe for a bike ride, we encounter squirrels according to a Poisson process with a rate of 4 squirrels per 10 blocks.

a) What is the probability of not encountering any squirrels in 1 block? (0.5 pt)

b) What is the probability of not encountering any squirrels in 20 blocks? (0.5 pt)

c) What is the probability of encountering 4 squirrels in 10 blocks? (0.5 pt)

d) What is the probability of encountering at least 2 squirrels in 10 blocks? (0.5 pt)

e) What is the probability that exactly 4 of the 10 blocks contain no squirrels? (0.5 pt)