ESI 4606: Analytics I - Foundations of Data Science
Homework 2
Due: September 21$^{\text{st}}$ (11:00AM), 2022

Problem 1 (2 points)

Consider randomly selecting a student at USF, and let A be the event that the selected student has a Visa card and B be the analogous event for MasterCard. Suppose that $\Pr(A) = 0.6$ and $\Pr(B) = 0.4$

(a) Could it be the case that $\Pr(A \cap B) = 0.5$? Why or why not?

(b) From now on, suppose that $\Pr(A \cap B) = 0.3$. What is the probability that the selected student has at least one of these two types of cards?

(c) What is the probability that the selected student has neither type of card?

(d) Calculate the probability that the selected student has exactly one of the two types of cards.

Problem 2 (2 points)

A customer service center has 5 telephone lines. Let X denote the number of lines in use at a specified time. The probability mass function (pmf), $f(x)$, for X, is shown in Table 1.

Table 1: Table summary of the probability mass function

x	0	1	2	3	4	5
$f(x)$	0.10	0.15	0.20	0.25	0.20	0.10

(a) What is the corresponding cumulative distribution function (cdf), $F(x)$?

(b) Let event A={at most three lines are in use}, compute $\Pr(A)$.

(c) Let event B={fewer than two lines are in use}, compute $\Pr(B)$.

(d) Compute the mean and the variance of X, i.e., $E(X)$ and $\text{Var}(X)$.

Problem 3 (1 point)

The lifetime of a certain brand of lightbulb has an exponential distribution with a mean of 800 hours. **Use R** to answer the following questions. [Hint: Using help() to learn R functions (e.g., dexp,pexp,qexp,rexp) related to the exponential distribution.]

(a) Find the probability that a randomly selected lightbulb of this kind lasts 700 to 900 hours.

(b) Find the probability that a randomly selected lightbulb of this kind lasts longer than 850 hours.

(c) Find the 80th percentile of the lifetime of this kind of lightbulb.

Note: **To get full points, include R codes in the appendix sections**