

# Stat 400/Math 463 Homework 1

**Fall 2023 - Yu**

**Due: Fri Sep 8 – 11:59pm via Gradescope**

Note: *You are welcome to round to 2 or 3 decimals places, or leave your answer as a fraction.*

## Exercise 1

Assume that the probability Nick finds Jess crying at 9pm given that she has **not** watched Dirty Dancing that evening is 0.2. The probability that Jess is crying at 9pm given that she has watched Dirty Dancing is 0.9. Assume that there is an overall probability of 0.7 that Jess watches Dirty Dancing on any given evening.

- (1 pt) If Jess is crying at 9pm, find the probability that she has not watched Dirty Dancing that evening.
- (1 pt) If Jess is not crying at 9pm, find the probability that she has already had watched Dirty Dancing that evening.

## Exercise 2

Draw one card at random from a standard deck of cards. The sample space  $S$  is the collection of the 52 cards. Assume that the probability set function assigns  $1/52$  to each of the 52 outcomes. Let the following events be defined:

- $A = \{\text{Queen or King}\}$
- $B = \{\text{Spade}\}$
- $C = \{\text{Black Jack or Queen}\}.$

Find:

- (0.5 pt)  $P[A \cup B]$
- (0.5 pt)  $P[A \cap B]$
- (0.5 pt)  $P[A \cup (B \cap C)]$
- (0.5 pt)  $P[A^C \cup B]$

## Exercise 3

Suppose  $S = \{1, 2, 3, 4, 5, \dots\}$  and for any element of  $S$ ,

$$P[k] = c \frac{5^k}{k!}$$

Find the value of  $c$  that makes this a valid probability distribution. (2 pts)

## Exercise 4

Suppose  $S = \{2, 3, 4, \dots\}$  and

$$P[k] = \frac{c}{(5/2)^k}$$

- (1.5 pts) Find a value of  $c$  that makes this a valid probability distribution.

- b) (1 pt) Find  $P[\text{Outcome is } \textit{greater} \text{ than } 3]$ .

### Exercise 5

Suppose  $P[A] = 0.5$ ,  $P[B^C] = 0.3$ , and  $P[A \cap B] = 0.2$

- a) (0.5 pts) Find  $P[B|A]$
- b) (0.5 pts) Find  $P[B^C|A^C]$
- c) (0.5 pts) Find  $P[A^C|B]$