

Name: \_\_\_\_\_

MATH 308

Fall 2021

HW 18: Due 12/10

*"Programs must be written for people to read, and only incidentally for machines to execute."*

*–Harold Abelson*

**Problem 1.** (10pt) There are 46 employees at a video game company. The company recently put out an immersive RPG. Of their employees, 14 worked on the story development and 13 worked on the programming, with 3 employees acting as intermediaries between the two groups by working on both. Selecting an employee at random from the company, what is the probability that...

- (a) They worked on just the story?
- (b) They worked on the game at all?
- (c) They did not work on the game at all?
- (d) They worked on the story, assuming that they worked on the programming?
- (e) A story writer worked on the programming?

**Problem 2.** (10pt) A randomized algorithm uses two primary subroutines. The first subroutine is used 20% of the time and gives a correct computation 59% of the time, while it crashes 40% of the time. The second subroutine gives the correct answer 50% of the time.

- (a) Find the probability that the program uses the second subroutine to find the correct answer.
- (b) Find the probability that the program gives the correct answer.
- (c) Find the probability that the program crashes.
- (d) Find the probability that the program uses the first subroutine, assuming it found the correct answer.
- (e) Find the probability that the program used the second subroutine, if the program crashed.

**Problem 3.** (10pt) A weighted six-sided die has probabilities (partially) given below:

$n$	1	2	3	4	5	6
$P(n)$	$\frac{7}{20}$	$\frac{1}{20}$	$\frac{2}{20}$		$\frac{4}{20}$	$\frac{4}{20}$

Suppose a game is played using this die where if one rolls a 6, you win \$10, if you roll a 4 or 5 you win nothing, and if you roll a 2 or 3, you lose \$2, and if you roll a 1 you lose \$3.

- (a) Complete the probability table above.
- (b) Find the probability of rolling at least one 6 every 10 rolls.
- (c) Find the expected value. Should one play this game? Explain.
- (d) What if one had to pay \$1 to play the game each time? How does this change the answer from (c)?

**Problem 4.** (10pt) A “2<sup>2</sup>-face” in a card game consists of having 2 face cards and 2 two’s in one’s five card hand. Being dealt five random cards from a standard 52 card deck, find the probability that one receives a “2<sup>2</sup>-face.”

**Problem 5.** (10pt) Find the probability of getting a three of a kind in standard 5 card poker.