

Homework 2

Rajat Mahesh Gupta

Problem 0: You are playing a game at a carnival, the game involves rolling a 3 sided dice where: Rolling a

- 1 has probability of 0.2
- 2 has probability of 0.5
- 4 has probability of 0.3

If you land on the dice face 2, you get to flip a fair coin otherwise you will flip an unfair coin such that $P(\text{Tails})=0.30$. Let X be a random variable that represents the number of dots you see on a face of the dice, and Y be an indicator variable on whether the coin shows a head when flipped.

```
set.seed(123)

n <- 10000000

dice_rolls <- sample(c(1, 2, 4), size = n, replace = TRUE, prob = c(0.2, 0.5, 0.3))

# Simulate coin flips based on dice rolls
coin_flips <- sapply(dice_rolls, function(x) {
  if (x == 2) {
    # Fair coin flip
    sample(c(0, 1), size = 1, replace = TRUE, prob = c(0.5, 0.5))
  } else {
    # Unfair coin flip
    sample(c(0, 1), size = 1, replace = TRUE, prob = c(0.3, 0.7))
  }
})

# Calculate X + 4Y
X_plus_4Y <- dice_rolls + 4 * coin_flips

# Calculate the variance of X + 4Y
variance_X_plus_4Y <- var(X_plus_4Y)

# Print the result
cat("var[X+4Y] = ", variance_X_plus_4Y)
```

Find $\text{var}(X+4Y)$

```
## var[X+4Y] = 5.400563
```