MATH230 Week 13 Worksheet - Random Variables

1: An unfair coin with probability ¾ of landing on heads is tossed thrice. Let X be the amount of heads. Draw a histogram and use it to find the mean, median, and mode of X.
2: The table below lists an alleged probability distribution for a discrete random variable X. Find two reasons why this isn't a probability distribution.

x	-3	-2	-1	0	1	2
P(X=x)	0.2	0.4	0.3	-0.2	0.1	0.1

3: If 3 batteries are randomly plucked from a bag containing 10, of which 2 are defective, what is the expected number of defective batteries among those selected?

4: John opens a brand new deck of 52 cards and shuffles it fairly. What is the expected number of cards that remain in their original position?

5: A woman purchased a $20,000, 1-year term-life insurance policy for $260. Assuming that the probability that she will live another year is .99, find the company's expected gain.

6: Martin Gale heads to the roulette table. He bets $1 on black and every time he loses, he doubles the bet size until he wins, at which point he switches back to the original $1 bet size. Has this man fooled the casino? Let's find out. **Note:** The wheel has 1 green, 18 black, and 18 red numbers. If you win betting on red or black, you win exactly your bet.

(a): Find the amount he profits each time he completes a cycle.

(b): If he lost k-1 bets in a row, find the expected value of the kth bet in the cycle.

(c): If you did parts a and b correctly, the answers seem to contradict each other. What is the resolution to this paradox? Hint: Martin does not have infinite money.

7: You are playing Virtual Bandersnatch: Rags to Riches. You start with $1 and your goal is to reach 1 million dollars by betting on a coin toss. If you land on heads, you lose your bet. If you land on tails, your bet triples. What percentage of your funds should you bet every time to minimize the expected number of flips needed to succeed?

8: A magic 6 sided die is labeled 0, 1, 1, 2, 2, 2 on the six sides. If you roll a 0, the die disappears. If you roll a 1, nothing happens. If you roll a 2, an identical magic die appears. What's the probability that the die and its descendants die out if you keep rolling everything?