1) A dice game is played as follows: The player rolls two dice. If the product of the results is even, then the player loses $8.00, if the product is odd, then the player wins $20.00. Find the expected payoff.

2a) Find \( E(x) \) (find \( \mu \))

<table>
<thead>
<tr>
<th>( x )</th>
<th>( P(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>.4</td>
</tr>
<tr>
<td>10</td>
<td>.3</td>
</tr>
<tr>
<td>15</td>
<td>.2</td>
</tr>
<tr>
<td>20</td>
<td>.1</td>
</tr>
</tbody>
</table>

b) Find the standard deviation

3) Susan takes an 18 question multiple choice test. Each question has answers A, B, C, and D. She guesses on all of them. A) What is her expected score? B) Find the standard deviation. C) Use a normal approximation to estimate the probability that she scores at least 10, but no more than 15.

D) Is there a potential problem with our approximation in part C?

4) Let \( X \) be the number of face cards that show up when randomly choosing three cards from a standard 52 card deck. (without replacement). Show the probability density function on the table to the left, then draw a bar chart with the information from the table in the middle, then, on the right, construct a histogram from the data. Round the probabilities to 3 decimal places.

5) For what value of \( c \) is the following a probability distribution function? \( f(x) = \frac{c}{x^2} \) \( x = 1, 2, 3, 4 \)

(The key here is that the probabilities must have a sum of 1)

6) Given the following probability distribution function:

\[
p(x) = \frac{(x-2)^2 + 1}{20} \quad x = 1, 2, 3, 4, 5
\]

a) Find the probability that \( x = 4 \).

b) Find \( E(x) \) (The Expected value of \( x \)).

c) Find the Variance and Standard Deviation

7) 100 children play a dice game. They roll a die. If they roll a six, they win a toy bunny.

A) Find the mean number of winners

B) Find the standard deviation

C) Can we use a normal approximation?

D) Approximate the probability that the number of winners is at least 10, but no more than 20.

E) Approximate the probability that more than 25 children win.

8) Assume that \( X \) follows a normal distribution with a mean of 0 and standard deviation of 1. “N(0, 1)” Find the following probabilities. **Round to 4 decimal places.**

a) \( P(x < 1) \)

b) \( P(x \geq 1.27) \)
c) \( P(-2.33 \leq x \leq .48) \)

d) \( P(x < -1) \)

9) The length of the adult male Brazilian Barking Tree Fish follows a normal distribution with a mean of 47 cm and a standard deviation of 8 cm. **Round to 4 decimal places.** If one of these tree fish is selected at random,

a) Find the probability that it is less than 47 cm long.

b) Find the probability that it is more than 55 cm long.

c) Find the probability that it is between 38 cm and 43 cm long.

d) Find the probability that it is more than 60 cm long.

10) If the height of an adult Martian follows a normal distribution with a mean of 3.2 feet and a standard deviation of 0.3 feet; **(Round to 4 decimal places)**

a) 20% of adult Martians are shorter than what height?

b) 5% of adult Martians are taller than what height?

c) 90% of adult Martians are less than how many inches from the mean?

Solutions

1) –$1.00  2a) 10  b) 5  3a) 4.5  b) 1.8371  c) about .0032  d) Yes. It may not be a good approximation, np = 4.5 but should be at least 10. (We shouldn't use this approximation)

4)

<table>
<thead>
<tr>
<th>x</th>
<th>( P(X=x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.447</td>
</tr>
<tr>
<td>1</td>
<td>.424</td>
</tr>
<tr>
<td>2</td>
<td>.119</td>
</tr>
<tr>
<td>3</td>
<td>.010</td>
</tr>
</tbody>
</table>

5) \( \frac{144}{205} \)  6a) \( \frac{1}{4} \)  b) 4  c) variance 1.7, std dev 1.3038

7a) \( 16.6667 \)  b) \( 3.7268 \)  c) Yes (n is at least 30, np and nq are both at least 10)

d) \( .8209 \)  e) \( .0089 \)

8a) .8413  b) .1020  c) .6745  d) .1587

9a) .5000  b) .1587  c) .1782  d) .0521

10a) 2.9475 ft  b) 3.6935 ft  c) 5.9215 inches (.4935 ft)