

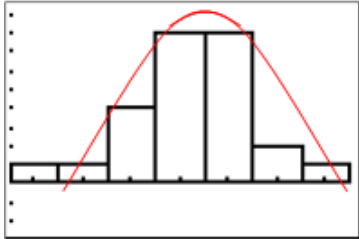
Chapter 4 – Probability Distributions

4.1 Normal Distributions

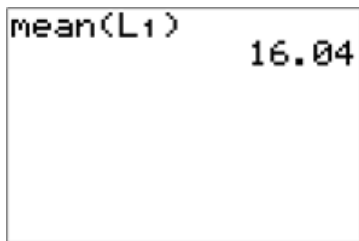
Answer Key

Answers

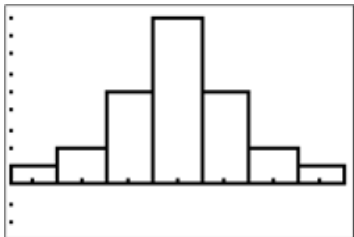
1. The data gives the following histogram:



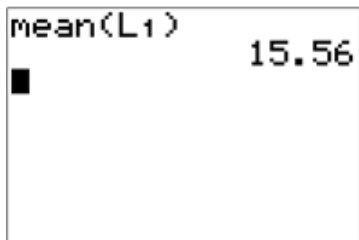
The data does not appear to be normally distributed but does appear to have a good spread of the data. For a quiz out of 25, the lowest score was 2 and the highest was 25. The mean score was 16.04.



2. The data the manager collected can be plotted to give the following histogram:



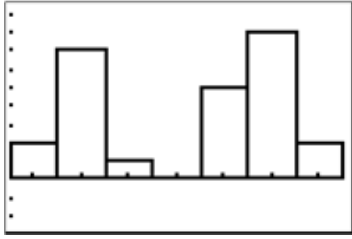
This data does appear to be normally distributed about the mean.



The movie is rated PG, with an additional violence warning. A mean age of 15.56 years for moviegoers tells the manager that there are a number of very young people attending. When he looks at the survey results, he can see that there are indeed children as young as 5 going to the movie.

to the movie.

3. The data collected from the survey can be plotted to give the following histogram:



This data is obviously not normally distributed, but is in two distinct groups. It appears that there is one group growing well, with a mean height between 21 and 25 feet (upper part of the histogram), and one group not growing so well, with a mean height between 6 and 10 feet (lower part of the histogram). In this part of the park, the park warden may need to look to see if there is a problem, such as a beetle or other pest that is invading the trees.

4. No, the data points cannot be connected when graphed, because this is discrete data.
5. Yes, the data points can be connected when graphed, because this is continuous data.
6. No, the data points cannot be connected when graphed, because this is discrete data.
7. Yes, the data points can be connected when graphed, because this is continuous data.
8. Yes, the data points can be connected when graphed, because this is continuous data.
9. No, the data points cannot be connected when graphed, because this is discrete data.
10. Yes, the data points can be connected when graphed, because this is continuous data.

4.2 Binomial Distributions

Answers

1. The answers are as follows:
 - b. The data is discrete, so it could be a binomial distribution.
 - c. The data is discrete, so it could be a binomial distribution.
 - d. The data is continuous, so it could not be a binomial distribution.
 - e. The data is continuous, so it could not be a binomial distribution.
2. The binomial distributions are a and b. Of these 2 distributions, b more closely approximates a normal distribution.
3. The answers are as follows:
 - a. The data is continuous, so it could not be a binomial distribution.
 - b. The data is discrete, so it could be a binomial distribution.
 - c. The data is continuous, so it could not be a binomial distribution.
 - d. The data is discrete, so it could be a binomial distribution.
4. The binomial distributions are b and d. Of these 2 distributions, d more closely approximates a normal distribution.
5. The probability of getting exactly 4 heads can be calculated as follows:

$$P(4 \text{ heads}) = {}_7C_4 \times \left(\frac{1}{2}\right)^4 \times \left(\frac{1}{2}\right)^3$$

$$P(4 \text{ heads}) = 35 \times \frac{1}{16} \times \frac{1}{8}$$

$$P(4 \text{ heads}) = \frac{35}{128} = 0.273 = 27.3\%$$

6. The probability of getting exactly 3 tails can be calculated as follows:

$$P(3 \text{ tails}) = {}_9C_3 \times \left(\frac{1}{2}\right)^3 \times \left(\frac{1}{2}\right)^6$$

$$P(3 \text{ tails}) = 84 \times \frac{1}{8} \times \frac{1}{64}$$

$$P(3 \text{ tails}) = \frac{84}{512} = \frac{21}{128} = 0.164 = 16.4\%$$

7. The probability of getting exactly 6 heads can be calculated as follows:

$$P(6 \text{ heads}) = {}_8C_6 \times \left(\frac{1}{2}\right)^6 \times \left(\frac{1}{2}\right)^2$$

$$P(6 \text{ heads}) = 28 \times \frac{1}{64} \times \frac{1}{4}$$

$$P(6 \text{ heads}) = \frac{28}{256} = \frac{7}{64} = 0.109 = 10.9\%$$

8. The probability of getting exactly 2 tails can be calculated as follows:

$$P(2 \text{ tails}) = {}_6C_2 \times \left(\frac{1}{2}\right)^2 \times \left(\frac{1}{2}\right)^4$$

$$P(2 \text{ tails}) = 15 \times \frac{1}{4} \times \frac{1}{16}$$

$$P(2 \text{ tails}) = \frac{15}{64} = 0.234 = 23.4\%$$

9. South Hampton's graph would more likely approximate a normal distribution, because it produced more data, and the more data there is, the more likely a binomial distribution is to approximate a normal distribution.

10. Graph b is most likely the one for North Liberty, and graph a is most likely the one for North Hampton. This is because graph a more closely approximates a normal distribution.

4.3 Binompdf Function

Answers

1. The probability that they will have exactly 2 boys is 0.3456, or 34.56%.





2. The probability that 4 will come up tails is 0.1611, or 16.11%.

```
binompdf(11, .5, 4)
.1611328125
```

3. The probability that the spinner lands on yellow 45 times is 0.0626, or 6.26%.

```
binompdf(75, .65,
45)
.0625579009
```

4. The probability of getting a 4 or greater 14 times is 0.1328, or 13.28%.

```
binompdf(25, .5, 1
4)
.1328408718
```

5. The probability that Amy's alarm clock goes off when it is supposed to on 6 days is 0.2573, or 25.73%.

```
binompdf(7, .95, 6)
.2572821617
```

6. The probability of randomly guessing the correct answer to 8 questions is 0.022, or 2.2%.

```
binompdf(20, .2, 8)
```

```
)  
    .0221608768
```

7. The probability that Bob choosing a diamond 5 times is 0.1651, or 16.51%.

```
binompdf(15, .25,  
5)  
    .1651459811
```

8. The probability that 10 game cards are winners is 0.1319, or 13.19%.

```
binompdf(100, .1,  
10)  
    .1318653468
```

9. The probability that none of the people chose a 6 is 0.3487, or 34.87%.

```
binompdf(10, .1, 0  
)  
    .3486784401
```

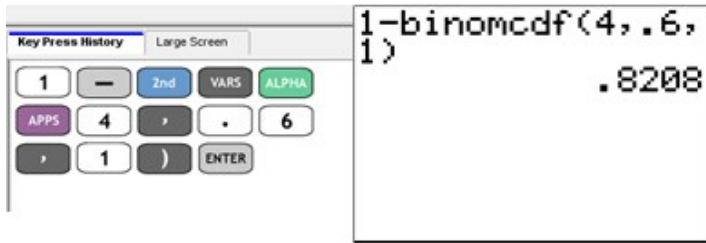
10. The probability of getting your tax return audited exactly once in the next 5 years is 0.4069, or 40.69%.

```
binompdf(5, .18, 1  
)  
    .406909584
```

4.4 Binomcdf Function

Answers

1. The probability that Janet and David will have at least 2 boys is 0.8208, or 82.08%.



The image shows a TI-84 Plus calculator keypad on the left and a large screen on the right. The keypad has buttons for '1', '-', '2nd', 'VARS', 'ALPHA', 'APPS', '4', ',', '.', '6', '1', ')', and 'ENTER'. The screen displays the command $1 - \text{binomcdf}(4, .6, 1)$ and the result $.8208$.

2. The probability that Janet and David will have at most 2 boys is 0.5248, or 52.48%.



The image shows a TI-84 Plus calculator keypad on the left and a large screen on the right. The keypad has buttons for '2nd', 'VARS', 'ALPHA', 'APPS', '4', ',', '.', '6', ',', '2', ')', and 'ENTER'. The screen displays the command $\text{binomcdf}(4, .6, 2)$ and the result $.5248$.

3. The probability that it rains on 2 or more of the days is 0.5248, or 52.48%.

$$1 - \text{binomcdf}(4, .4, 1)$$
$$.5248$$

4. The probability of getting 15 or fewer heads is 0.2498, or 24.98%.

$$\text{binomcdf}(35, .5, 15)$$
$$.2497799154$$

5. The probability of getting at least 28 tails is 0.0083, or 0.83%.

$$1 - \text{binomcdf}(40, .5, 27)$$
$$.0082945017$$

6. The probability of getting selected for jury duty in at most 2 of the next 5 years is 0.9937, or 99.37%.

$$\text{binomcdf}(5, .09, 2)$$
$$.9936587206$$

7. The probability of getting fewer than 7 clubs is 0.6074, or 60.74%.

```
binomcdf(24, .25,  
6)  
.6074123375
```

8. The probability that Brady wins at least twice is 0.0932, or 9.32%.

```
1-binomcdf(13, .0  
4, 1)  
.0931895592
```

9. The probability of getting more than 106 even numbers is 0.1790, or 17.90%.

```
1-binomcdf(200, .  
5, 106)  
.1790015383
```

10. The probability that you get stopped by a red light 3 or fewer times is 0.5226, or 52.26%.

```
binomcdf(22, .16,  
3)  
.5226478639
```

4.5 Geometric Distributions

Answers

1. a and b are geometrically distributed

2. 0.031

3. 0.027

4. Answer:

a (number of rolls)	Probability
1	$\binom{5}{6} \times \frac{1}{6} = .167$
2	$\binom{5}{6} \times \frac{1}{6} = .139$
3	$\binom{5}{6} \times \frac{1}{6} = .116$
4	$\binom{5}{6} \times \frac{1}{6} = .096$
5	$\binom{5}{6} \times \frac{1}{6} = .080$
6	$\binom{5}{6} \times \frac{1}{6} = .067$
7	$\binom{5}{6} \times \frac{1}{6} = .056$
8	$\binom{5}{6} \times \frac{1}{6} = .047$

5. 0.034

6. 0.220

7. 0.167

8. 0.139; 0.116

9. 0.579

10. 0.070