Step 1: 6 is # of classes.

Step 2: \( \frac{30 - 9}{6} = \frac{21}{6} = 3.5 \approx 4 \) = class width.

Step 3: 9 is starting point.

Step 4: Add 4 to get the second lower class = 13

Then continue 17, 21, 25, 29

Step 5: Upper classes = 12, 16, 20, 24, 28, 32

Step 6: Classes | Frequency | Rel. freq | Cum. freq
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9 - 12</td>
<td>3</td>
<td>17%</td>
<td>3</td>
</tr>
<tr>
<td>13 - 16</td>
<td>2</td>
<td>11%</td>
<td>5</td>
</tr>
<tr>
<td>17 - 20</td>
<td>2</td>
<td>11%</td>
<td>7</td>
</tr>
<tr>
<td>21 - 24</td>
<td>3</td>
<td>17%</td>
<td>10</td>
</tr>
<tr>
<td>25 - 28</td>
<td>6</td>
<td>33%</td>
<td>16</td>
</tr>
<tr>
<td>29 - 32</td>
<td>2</td>
<td>11%</td>
<td>18</td>
</tr>
</tbody>
</table>

\( 100\% \)

Rel. freq

![Graph showing class boundaries and frequencies](image-url)
2) a) Dotplots

The actual high temp ranges from 55° to 85° with the most reading in the 75° and 80° distribution is skewed.

b) Stemplots

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>0, 5, 5</td>
</tr>
<tr>
<td>7</td>
<td>5, 5, 5</td>
</tr>
<tr>
<td>8</td>
<td>0, 0, 0, 0, 5</td>
</tr>
</tbody>
</table>

Distribution is skewed

3) Scatterplot

Yes, as x increases, y decreases for the most part. Relationship: because the dots are closer to each other.
Chapter 3 Exercises Solutions

1) Sort the data

\[9 \ 10 \ 12 \ 13 \ 16 \ 19 \ 20 \ 22 \ 24 \ 24 \ 25 \ 25 \ 26 \ 27 \ 28 \]

\[28 \ 29 \ 30 \ \overset{Q_1}{\Rightarrow} \]

Mean: \[\frac{387}{18} = 21.5\]

Median: position \(\frac{n+1}{2} = \frac{19}{2} = 9.5^{th}\)

\[
\frac{24+24}{2} = 24
\]

Mode: 24, 25, 28 = Multimodal

Range: \[\frac{30-9}{2} = \frac{21}{2} = 10.5\]

\[Q_1 = 16 \quad Q_2 = 24 \quad Q_3 = 27\]

5-Number Summary

\[\text{Min} = 9 \quad Q_1 = 16 \quad Q_2 = 24 \quad Q_3 = 27 \quad \text{Max} = 30\]

Box plot

\[\begin{array}{c}
9 \\
16 \\
24 \\
27 \\
30
\end{array}\]

No outlier.

2) Mean = \[
\frac{6.2 + 2.7 + 5.4 + 8.1 + 5.2 + 4.9 + 7.8}{7}
\]

Step 1: \[\frac{40.3}{7} = 5.75\]
Deviation

\[ \overline{X} \]

\[
\begin{array}{c|c|c}
X - \overline{X} & (X - \overline{X})^2 & \sum (X - \overline{X})^2 \\
6.2 - 5.75 & (4.75)^2 & 20.025 \\
2.7 - 5.75 & (-3.05)^2 & 9.3025 \\
5.4 - 5.75 & (-0.35)^2 & 0.1225 \\
8.1 - 5.75 & (2.35)^2 & 5.5225 \\
5.2 - 5.75 & (-0.55)^2 & 0.3025 \\
4.9 - 5.75 & (-0.85)^2 & 0.7225 \\
7.8 - 5.75 & (2.05)^2 & 4.2025 \\
\end{array}
\]

\[
\sum (X - \overline{X})^2 = 20.3775 \\
\]

\[
\frac{\sum (X - \overline{X})^2}{n - 1} = \frac{20.3775}{6} \\
\]

\[
S^2 = 3.39625 \\
\]

\[
S = \sqrt{3.39625} = 1.84
\]

(3)

\[
\overline{X} = 71.3, \quad S = 5.5
\]

\[
68\% = \overline{X} \pm 1.645(5) = 71.3 \pm 5.5 \quad [65.8, 76.8]
\]

\[
95\% = \overline{X} \pm 1.96(5) = 71.3 \pm 2(5.5) \quad [60.3, 82.3]
\]

\[
99.7\% = \overline{X} \pm 2.57(5) = 71.3 \pm 3(5.5) \quad [54.8, 87.8]
\]

a) [65.8, 87.8]

b) 95\%.

\[
\overline{X} = 58, \quad x = 80, \quad \overline{X} = 63.6
\]

\[
S = 2.5
\]

\[
Z = \frac{X - \overline{X}}{S} = \frac{58 - 63.6}{2.5} = -2.24 \text{ in}
\]

\[
\text{Minimum height}
\]

\[
\text{Maximum height}
\]

This height is unusual because it is outside -2 \pm 2\

This height is unusual because it is outside -2 \pm 2.
a) percentile of 47 = \frac{9}{24} \cdot 100 = 37.5 \text{ th percentile}

b) percentile of 65 = \frac{20}{24} \cdot 100 = 83.33 \approx 83 \text{ th percentile}

c) percentile of 54 = \frac{12}{24} \cdot 100 = 50 \text{ th percentile}

d) percentile of 41 = \frac{2}{24} \cdot 100 = 8.33 \approx 8 \text{ th percentile}

* Indicated percentile, n = 24

\( P_{20} = \frac{20}{100} \cdot 24 = 4.8 \approx 5 \text{ th position} \)

\[ P_{20} = 39 \]

b) \( Q_1 = P_{25} \) \[ L = \frac{25}{100} \cdot 24 = 6 \]

\( P_{25} = \) between 6 th and 7 th

\[ P_{25} = \frac{41 + 43}{2} = 42 \]

\[ Q_1 = 42 \]

c) \( P_{80} \) \[ L = \frac{80}{100} \cdot 24 = 19.2 \approx 20 \text{ th position} \]

\[ P_{80} = 61 \]

d) \( Q_3 = P_{75} \) \[ L = \frac{75}{100} \cdot 24 = 18 \text{ th} \]

\[ P_{75} = 18 \text{ th and } 19 \text{ th} = \frac{59 + 61}{2} = 60 \]

\[ P_{75} = 60 \]
Section 4.2

1. We will use the relative frequency approach.

\[ P(\text{crash}) = \frac{\text{number of cars that crashed}}{\text{total number of cars}} \]

\[ = \frac{6,511,100}{135,670,000} = 0.0480 \]

Note: The classical approach cannot be used since the two outcomes (crash, no crash) are not equally likely.

2. Sample space = 98
   57 of them are positive test result (15 + 42)
   Each test is equally likely to be selected

\[ P(\text{positive test result}) = \frac{\text{number of positive test results}}{\text{total number of results}} \]

\[ = \frac{57}{98} = 0.582 \]

3. Sample space = AA, Aa, aA, aa  \( n = 4 \)
   Each are equally likely.

\[ P(\text{outcome with two different components}) = \frac{2}{4} = 0.5 \]
(1) Sample space: Boy = b, Girl = g
\[\{ bbb, bbg, bgb, bgg, gbb, gbg, ggb, ggg \} \quad n = 8 \]
Equally likely.

a) \( P(\text{exactly 2 boys}) = \frac{3}{8} = 0.375 \)

b) \( P(\text{All girls}) = \frac{1}{8} = 0.125 \)

c) \( P(\text{oldest is a boy}) = \frac{4}{8} = \frac{1}{2} = 0.5 \)

(2) Summarize the given information first:

- 1941: gain in business
- 1260: business remains the same
- 204: loss in business

\[ \text{Total responses} = 3405 \]

Use the relative frequency approach.

\[ P(\text{response of a gain in business}) = \frac{1941}{3405} = 0.570 \]

(3) a) Thanksgiving Day always falls on the fourth Thursday in November.
   Therefore, it is impossible to fall on Wednesday.
   \[ P(\text{impossible event}) = 0 \]

b) It is certain it will fall on Thursday.
   \[ P(\text{certain}) = 1 \]
7) A denotes the complement of event A, meaning that event A does not occur.

\[
P(A) = 0.995 \\
\therefore P(\overline{A}) = 1 - 0.995 = 0.005
\]

\(\overline{A}\) is unusual because it is very unlikely to occur.

8) \(P(\text{not assigning Hmk}) = 0.12\)

\(P(\text{Assigning Hmk}) = 1 - 0.12 = 0.88\)

Odds in favor = \[
\frac{P(\text{Assigning Hmk})}{P(\text{not Assigning Hmk})} = \frac{0.88}{0.12} = \frac{22}{3}
\]

9) Roulette: 0, 00, 1, 2, ..., 36

38 total slots

a) With \(P(13) = \frac{1}{38}\) and \(P(\text{not } 13) = \frac{37}{38}\)

Actual odd against 13 = \[
\frac{P(\text{not } 13)}{P(13)} = \frac{37/38}{1/38} = \frac{37}{1}
\]

37:1

b) Because the payoff odds against 13 are 35:1 we have 35:1 = \(\text{(net profit)} / \text{amount bet}\)

So, there is a $85 profit for each $1 bet.

For a $5 bet, \(\text{net profit} = 5 \times 35 = 175\)

So win = you collect $175 plus your $5 = $180
Section 4.3

1. Remember when finding the probability that event A occurs or event B occurs, find the total of the number of ways A occurs and the number of ways B occurs but find that total in such a way that no outcome is counted more than once. Here total \( n = 98 \)

a) \( P(\text{A positive test result or lied}) \)

\[ A \text{ can occur } = 15 + 42 = 57 \]
\[ B \text{ can occur } = 9 = 9 \]

\[ \frac{66}{98} = 0.673 \]

b) \( P(\text{Negative test result or did not lie}) \)

\[ A \text{ can occur } = 32 + 9 = 41 \]
\[ B \text{ can occur } = 15 = 15 \]

\[ \frac{56}{98} = 0.571 \]

c) We see that there are 41 subjects (32 + 9) with test results and there are 47 subjects (32 + 15) did not lie.

A and B can occur at the same time because both have 32 subjects. Since events overlap, they can occur at the same time and we say that the events are not disjoint.
\[ P(\text{cleared}) = 0.624 \]

\[ P(\overline{\text{cleared}}) = 1 - 0.624 = 0.376 \]
Section 4.4 - Exercises

1) 2 subjects \( n = 98 \)
* First selection
\[ P(\text{positive test result}) = \frac{42 + 15}{98} = \frac{57}{98} \]
* Second selection
\[ P(\text{negative test result}) = \frac{32 + 9}{97} = \frac{41}{97} \]
Since no replacement after the first selection so there are 97 remaining.
\[ P(\text{first and second}) = P(\text{first}) \cdot P(\text{second | first}) = \frac{57}{98} \cdot \frac{41}{97} = 0.246 \]

2) \[ P(A \text{ and } B) = P(A) \cdot P(B) \]
   a) Since the selections are made with replacement the probability of event \( B \) is the same as the probability of event \( A \).
   \[ \# \text{ of } Rh^+ \text{ and } O = 39 \]
   total = 100
   \[ P(\text{Rh}^+ \text{ and } O) = \frac{39}{100} \cdot \frac{39}{100} = 0.052 \]
   Independent
   b) Without replacement
   \[ P(O \text{ and } Rh^+) = \frac{39}{100} \cdot \frac{38}{99} = 0.150 \]
   \[ = P(O) \cdot P(O | Rh^+) \]
To approach problem like this, use the formal multiplication rule.

\[ P(A \text{ and } B) = P(A) \cdot P(B|A) \]

2 deaths

* First deaths \( n = 171 \)

\[ P(A) = \frac{\# \text{ of ways } A \text{ can occur}}{\text{total}} = \frac{\# \text{ intoxicated driver}}{171} \]

\[ \frac{22 + 20}{171} = \frac{42}{171} = 0.24561 \]

* Second deaths (remember no replacement)

Now total = 170

\# of intoxicated drivers = 41

\[ P(B|A) = \frac{41}{170} = 0.24118 \]

\[ P(A \text{ and } B) = P(A) \cdot P(B|A) = 0.24561 \cdot 0.24118 = 0.0592 \]
Section 5.2 Exercise

\[ \mu = \sum [(x, p(x))] \]
\[ = 0(0.02) + 1(0.15) + 2(-.29) + 3(-.26) + 4(.16) + 5(.12) \]
\[ = 0.00 + 0.15 - 0.58 + 0.78 + 0.44 + 0.6 \]
\[ = 2.75 \approx 2.8 \]

\[ \sigma^2 = (0 - 2.8)^2(0.02) + (1 - 2.8)^2(0.15) + (2 - 2.8)^2(-.29) + (3 - 2.8)^2(.26) + (4 - 2.8)^2(.16) + (5 - 2.8)^2(.12) \]
\[ = 0.1568 + 0.486 + 0.1856 + 0.0104 \]
\[ + 0.2304 + 0.5808 \]
\[ = 1.65 \]
\[ \sigma = \sqrt{1.65} \approx 1.28 \approx 1.3 \]
Example 1: Exercise 1 (5.3)

1. The procedure is a binomial distribution.
   1. Requirements:
   2. The number of trials (5) is fixed
   3. The 5 trials are independent because offspring pea having a green pod is not affected by the outcome of any other offspring pea.
   4. Each of the 5 trials has two categories of outcome, the pea has a green pod or it does not.
   4. For each offspring pea, the probability that it has a green pod is 3/4 or .75, and the probability remains the same for each of the 5 peas.

b) 1. n = 5
   2. x = 3 (exactly 3 peas).
   3. \( P(x) = \frac{3}{5} = 0.75 = p \).
   4. Prob of failure \( q = 1 - p = 1 - .75 = .25 \)

Exercise 2: Binomial

Exercise 3: Not binomial, because more than two possible outcomes.

Exercise 4: Not binomial, more than 2 possible outcomes.

Exercise 5: Binomial

Exercise 6: Not binomial, because the senators are selected without replacement, the events are not independent.
To find the probability of $x$ successes, use table A-1 Page 749.

15. Exercise 7
\[ n = 2 \quad x = 1 \quad p = 0.30 \]
\[ P(X) = P(1) = 0.420 \]

17. Exercise 8
\[ n = 15 \quad x = 11 \quad p = 0.99 \]
\[ P(11) = 0.4 \quad \text{Binom pdf} \left( 15, 0.99, 1 \right) \]

19. Exercise 9
\[ n = 10 \quad x = 2 \quad p = 0.05 \]
\[ P(2) = 0.075 \quad \text{Binom pdf} \left( 10, 0.05, 1 \right) \]
Exercise 2

\[ n = 1236, \ p = 0.14 \]

\[ \mu = np \]
\[ \sigma = \sqrt{np(1-p)} \]

\[ \mu = 1236 \times 0.14 \]
\[ = 173.0 \]

\[ \sigma = \sqrt{1236 \times 0.14 \times (1-0.14)} \]
\[ = \sqrt{173.0 \times 0.86} \]
\[ = \sqrt{148.8144} = 12.2 \]

Minimum usual = \[ 173 - 2(12.2) = 148.6 \]

Maximum usual = \[ 173 + 2(12.2) = 197.4 \]