Solutions to Practice Final Exam
Professor Wardrop
Fall 2015

1. We simply need to plug a pair of values for \( x \) and \( \hat{y} \) into the formula for the regression line. I will use

\[
x = 60 \quad \text{and} \quad \hat{y} = \text{Fit} = 185.23.
\]

This gives me

\[
185.23 = b_0 + 4.95(60); \quad \text{or} \quad b_0 = 185.23 - 297 = -111.77.
\]

2. I offer two solutions to this problem. First,

\[
\hat{y} = -111.77 + 4.95(65) = 209.98.
\]

Second, because the graph of \( \hat{y} \) versus \( x \) is a straight line, the value of \( \hat{y} \) at \( x = 65 \) is the mean of the values of \( \hat{y} \) at \( x = 64 \) and \( x = 66 \):

\[
(205.02 + 214.91)/2 = 209.965.
\]

The difference between these answers is due to round-off errors in the values 4.95 and -111.77. Thus, the second answer is better, but I would accept either one.

3. With \( n = 15 \) we have \( df = n - 2 = 13 \). Thus, \( t^* \) for 95% is (see table given) 2.160. Thus, the CI is

\[
4.95 \pm 2.160(1.325) = 4.95 \pm 2.86.
\]

4. For \( df = 13 \) the \( t^* \) for 90% is (see table given) 1.771. Thus, the CI is

\[
234.70 \pm 1.771(6.94) = 234.70 \pm 12.29.
\]

5. First, we calculate the estimated variance of the prediction:

\[
(14.61)^2 + (4.93)^2 = 237.757.
\]

Thus, the estimated standard error of the prediction is

\[
\sqrt{237.757} = 15.42.
\]

Thus, the 95% PI is

\[
224.81 \pm 2.160(15.42) = 224.81 \pm 33.31.
\]

6. We simply need to plug a pair of values for \( x \) and \( \hat{y} \) into the formula for the regression line. I will use

\[
x = 75 \quad \text{and} \quad \hat{y} = \text{Fit} = 188.47.
\]

This gives me

\[
188.47 = b_0 + 6.57(75); \quad \text{or} \quad b_0 = 188.47 - 492.75 = -304.28.
\]

7. I offer two solutions to this problem. First,

\[
\hat{y} = -304.28 + 6.57(72) = 168.76.
\]

Second, because the graph of \( \hat{y} \) versus \( x \) is a straight line, the value of \( \hat{y} \) at \( x = 72 \) is the mean of the values of \( \hat{y} \) at \( x = 69 \) and \( x = 75 \):

\[
(149.08 + 188.47)/2 = 168.775.
\]

The difference between these answers is due to round-off errors in the values 6.57 and -304.28. Thus, the second answer is better, but I would accept either one.

8. With \( n = 22 \) we have \( df = n - 2 = 20 \). Thus, \( t^* \) for 90% is (see table given) 1.725. Thus, the CI is

\[
6.57 \pm 1.725(0.9256) = 6.57 \pm 1.60.
\]
9. For \( df = 20 \) the \( t^* \) for 95% is (see table given) 2.086. Thus, the CI is

\[
188.47 \pm 2.086(4.59) = 188.47 \pm 9.57.
\]

10. First, we calculate the estimated variance of the prediction:

\[
(12.36)^2 + (5.02)^2 = 177.97.
\]

Thus, the estimated standard error of the prediction is

\[
\sqrt{177.97} = 13.34.
\]

Thus, the 90% PI is

\[
149.08 \pm 1.725(13.34) = 149.08 \pm 23.01.
\]

11. First, I enter the given data, below in boldfaced type; the other entries below are obtained by adding or subtracting.

<table>
<thead>
<tr>
<th>Shot</th>
<th>First</th>
<th>Second Shot</th>
<th>Total</th>
<th>( \hat{p} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>100</td>
<td>40</td>
<td>140</td>
<td>0.500</td>
</tr>
<tr>
<td>F</td>
<td>100</td>
<td>40</td>
<td>140</td>
<td>0.500</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>80</td>
<td>280</td>
<td>0.571</td>
</tr>
</tbody>
</table>

The only tricky part above is to note that Mona made 70% of her second free throws. Thus, we enter 70% of 200—140—into the column total for successes.

(a) This is an example of the use of the CI for \( [P(A) - P(B)] \) for paired data.

\[
\frac{60 - 90}{200} \pm 1.645 \sqrt{\frac{200(150) - 30^2}{199}} = -0.150 \pm 0.099.
\]

(b) We are now assuming a Chapter 15 problem which means that we present the data as follows:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>S</th>
<th>F</th>
<th>Total</th>
<th>( \hat{p} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>100</td>
<td>70</td>
<td>170</td>
<td>0.650</td>
</tr>
<tr>
<td>Second</td>
<td>130</td>
<td>70</td>
<td>200</td>
<td>0.650</td>
</tr>
<tr>
<td>Total</td>
<td>230</td>
<td>170</td>
<td>400</td>
<td>0.650</td>
</tr>
</tbody>
</table>

The CI is \((0.500 - 0.650)\pm\)

\[
1.645 \sqrt{\frac{0.5(0.5)}{200} + \frac{0.65(0.35)}{200}} = -0.150 \pm 0.080.
\]

(c) This was a trick question. Most students answered “Analysis (b) is better because its CI is narrower.” If you look at Nancy’s paired data, however, you see that she had a 40% success rate after a success and a 90% success rate after a failure. Even without performing Fisher’s test (the exact P-value for the two-sided alternative is \( 5.03 \times 10^{-14} \))

we can see that the assumption behind (b) is grossly contradicted by the data. Thus, the correct answer is (a).

12. (a) A CI for the mean is too small if, and only if, its upper bound is smaller than \( \mu \). We see that one upper bound—511—is smaller than \( \mu = 512 \); thus, one CI is too small.

A CI for the mean is too large if, and only if, its lower bound is larger than \( \mu \). We see that two lower bounds—526 and 534—are larger than \( \mu = 512 \); thus, two CIs are too large.

The remaining 17 CIs must be correct. (There is no double counting because a CI cannot be both too small and too large.)
(b) We are told that exactly three CIs are too small. This means that exactly three upper bounds are too small. Thus, 511, 522 and 543 are too small, but 549 is not too small. Thus, the answer is

\[ 543 < \mu \leq 549. \]

(c) We are told that at most four of the intervals are too large. This means that at most four of the lower bound are too large. This means that the fifth biggest lower bound—502—is not too large. Thus, the answer is

\[ \mu \geq 502. \]

13. The equation of the regression line is

\[ \hat{y} = b_0 + b_1x. \]

We do not have even information to calculate \( b_0 \) and \( b_1 \) directly, so we need a different approach. If we can find two pairs of \((x, \hat{y})\) that are on the regression line, then we will have two equations in two unknowns \((b_0 \text{ and } b_1)\) and we will be able to solve for the unknowns.

We know that the pair \((\bar{x}, \bar{y})\) is on the regression line; thus, we have our first pair: \((100, 150)\).

For the particular case we are given, we have

\[ -10 = e = y - \hat{y} = 210 - \hat{y}; \]

Thus, \( \hat{y} = 130 \) and the second pair is \((90, 130)\). This gives us our two equations:

\[ 150 = b_0 + 100b_1 \text{ and} \]

\[ 130 = b_0 + 90b_1. \]

If we subtract the second equation, side-by-side, from the first, we get

\[ 20 = 10b_1 \text{ or } b_1 = 2. \]

Plugging this answer into our first equation, we get

\[ 150 = b_0 + 2(100) \text{ or } b_0 = -50. \]

Thus, the regression line is

\[ \hat{y} = -50 + 2x. \]

14. The equation of the regression line is

\[ \hat{y} = b_0 + b_1x. \]

We do not have even information to calculate \( b_0 \) and \( b_1 \) directly, so we need a different approach. If we can find two pairs of \((x, \hat{y})\) that are on the regression line, then we will have two equations in two unknowns \((b_0 \text{ and } b_1)\) and we will be able to solve for the unknowns.

We know that the pair \((\bar{x}, \bar{y})\) is on the regression line; thus, we have our first pair: \((120, 160)\).

For the particular case we are given, we have

\[ 10 = e = y - \hat{y} = 210 - \hat{y}; \]

Thus, \( \hat{y} = 200 \) and the second pair is \((100, 200)\). This gives us our two equations:

\[ 200 = b_0 + 100b_1 \text{ and} \]

\[ 160 = b_0 + 120b_1. \]

If we subtract the second equation, side-by-side, from the first, we get

\[ 40 = -20b_1 \text{ or } b_1 = -2. \]
Plugging this answer into our first equation, we get

\[ 200 = b_0 - 2(100) \text{ or } b_0 = 400. \]

Thus, the regression line is

\[ \hat{y} = 400 - 2x. \]

15. First, we obtain

\[ s_p^2 = \frac{10(2.50)^2 + 20(4.74)}{30} = \frac{157.3}{30} = 5.2433. \]

Thus, \( s_p = \sqrt{5.2433} = 2.29. \)

16. Because \( s_d = 0, \) \( x - y = 3 \) for each pair. Thus,

<table>
<thead>
<tr>
<th>Subject</th>
<th>Treatment</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amy</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Sheldon</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Penny</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Leonard</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Bernie</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Emily</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Raj</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Howard</td>
<td>2</td>
<td>15</td>
</tr>
</tbody>
</table>

17. In the collapsed table,

\[ 7/14 = \hat{p}_1 > \hat{p}_2 = 4/10. \]

Thus, for SP to occur we need

\[ \hat{p}_1 < \hat{p}_2 \]

in both component tables.

(a) Next, using consistency, I can complete the Group 2 counts in Subgroup A

<table>
<thead>
<tr>
<th>Group</th>
<th>( S )</th>
<th>( F )</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>10</td>
<td>13</td>
</tr>
</tbody>
</table>

Next, I need to discover counts for Group 1 that gives the reversal we need and also satisfies consistency. One possible answer is below.

<table>
<thead>
<tr>
<th>Group</th>
<th>( S )</th>
<th>( F )</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>10</td>
<td>13</td>
</tr>
</tbody>
</table>

(b) After changing the second component table as directed, the first component table becomes:

<table>
<thead>
<tr>
<th>Group</th>
<th>( S )</th>
<th>( F )</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>3</td>
<td>11</td>
</tr>
</tbody>
</table>

For SP, we need \( \hat{p}_1 < 1/2 \) in Subgroup B, but this will force \( \hat{p}_1 > 1/2 \) and, hence, no reversal, in Subgroup A. (This conclusion follows from \( a = b = 7 \) in the collapsed table.)

18. (a) A false positive means \( (A^c B) \); thus, the answer is \( 80/2800 = 0.029. \)

(b) A correct test result is either a correct positive \( (AB) \) or a correct negative \( (A^c B^c) \). Thus, the answer is \( 2400/(280 + 2400) = 2400/2680 = 0.896. \)
(c) The answer is $280/360 = 0.778$.

(d) The answer is $40/2440 = 0.016$.

(e) The answer is

$$\frac{320 + 80}{2800} = \frac{400}{2800} = 0.143.$$ 

19. In the collapsed table,

$$\frac{4}{12} = \hat{p}_1 < \hat{p}_2 = \frac{4}{10}.$$ 

Thus, for SP to occur we need

$$\hat{p}_1 > \hat{p}_2$$

in both component tables.

(a) Next, using consistency, I can complete the Group 2 counts in Subgroup A

<table>
<thead>
<tr>
<th>Group</th>
<th>$S$</th>
<th>$F$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

Next, I need to discover counts for Group 1 that gives the reversal we need and also satisfies consistency. One possible answer is below.

<table>
<thead>
<tr>
<th>Group</th>
<th>$S$</th>
<th>$F$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

(b) After changing the second component table as directed, the first component table becomes:

<table>
<thead>
<tr>
<th>Group</th>
<th>$S$</th>
<th>$F$</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

Subgroup A

For SP, we need $\hat{p}_1 > 1/3$ in Subgroup B, but this will force $\hat{p}_1 < 1/3$ and, hence, no reversal, in Subgroup A.

20. (a) Because the study is balanced,

$$s_p^2 = \frac{[(5.78)^2 + (5.02)^2]}{2} = \frac{58.6088}{2} = 29.3044,$$

which gives

$$s_p = \sqrt{29.3044} = 5.41.$$ 

Next, $df = 15 + 15 - 2 = 28; \text{ thus, } t^* = 1.701$. The CI is

$$2.00 \pm 1.701(5.41)\sqrt{\frac{2}{15}} = 2.00 \pm 3.36.$$ 

(b) First, using (a) for the first two terms in the identity, we get

$$s_d^2 = 58.6088 - 2(0.4)(5.78)(5.02) = 35.40,$$

which gives $s_d = \sqrt{35.40} = 5.95$.

Next, $df = 15 - 1 = 14$, which gives $t^* = 1.761$. The CI is

$$2.00 \pm 1.761(5.95/\sqrt{15}) = 2.00 \pm 2.71.$$ 

(c) Raymond’s is preferred. As discussed in the Course Notes in Chapter 20, pairing independent samples is invalid.

21. (a) For 90% confidence, we have

$$k' = \frac{39 + 1}{2} - \frac{1.645\sqrt{39}}{2} = 20 - 5.13 = 14.87.$$ 

Thus, $k = 14$ and the CI extends from the 14th smallest observation to the 14th largest observation:

$$[148, 181].$$
(b) From (a), the CI for \( k = 14 \) has width equal to \( 181 - 148 = 33 \); i.e., it is not wide enough. I resort to trial-and-error. Fortuitously, my first candidate is \( k = 12 \) which gives the interval 
\[
[145, 200]
\]
which has the proper width!

(c) By inspecting the list of data, we see that 154 is the 16th smallest observation. Thus, \( k = 16 \) and the upper bound is the 16th largest observation, 173.

(d) My writing the PI with the ‘±’ symbol is a bit tricky. We find that the PI has bounds 
\[
181 - 66 = 115 \quad \text{and} \quad 181 + 66 = 247.
\]
By inspecting the list of data, we see that \( k = 3 \). Thus, the level of the PI is:
\[
1 - \frac{2(3)}{39 + 1} = 1 - 0.15 = 0.85.
\]

22. We can rule out Type 1 sampling because, for example, the relative frequency of \( A \) in the sample, 0.667, does not match \( P(A) = 0.500 \).
Next, we see that
\[
\hat{p}_1 = \frac{80}{200} = 0.4 \quad \text{and} \quad \hat{p}_2 = \frac{20}{100} = 0.2,
\]
equal, respectively,
\[
p_1 = \frac{200}{500} \quad \text{and} \quad p_2 = \frac{100}{500}.
\]
Finally, neither
\[
\hat{p}_1^* = \frac{80}{100} = 0.8 \quad \text{nor} \quad \hat{p}_2^* = \frac{120}{200} = 0.6,
\]
equal
\[
p_1^* = \frac{200}{300} \quad \text{nor} \quad p_2^* = \frac{300}{700}.
\]
Thus, Eli selected a Type 2 random sample.

23. This is a classic build a table of probabilities problem. First, we need to identify the two dichotomous variables. They are win (\( A \)) or lose (\( A^c \)); and riot (\( B \)) or don’t riot (\( B^c \)). The given information plus the multiplication rule yields the following table of probabilities.

<table>
<thead>
<tr>
<th></th>
<th>Riot</th>
<th>No riot</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Win</td>
<td>0.42</td>
<td>0.18</td>
<td>0.60</td>
</tr>
<tr>
<td>Lose</td>
<td>0.10</td>
<td>0.30</td>
<td>0.40</td>
</tr>
<tr>
<td>Total</td>
<td>0.52</td>
<td>0.48</td>
<td>1.00</td>
</tr>
</tbody>
</table>

For example, we are given the probability of winning is 0.60 and the probability of a riot given that the team wins is 0.70. Thus, the probability of winning and a riot is \( 0.60(0.70) = 0.42 \).

Once this table has been created, the problem becomes standard.

(a) From the table, the probability of a riot is 0.52.

(b) The probability of the team wins, given that there is no riot is
\[
P(W|R^c) = \frac{P(WR^c)}{P(R^c)} = \frac{0.18/0.48}{0.375} = 0.375.
\]

24. (a) The completed table is below.

<table>
<thead>
<tr>
<th>Findley’s Action</th>
<th>Outcome of shot:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Make</td>
</tr>
<tr>
<td>Bark</td>
<td>0.42</td>
</tr>
<tr>
<td>Howl</td>
<td>0.07</td>
</tr>
<tr>
<td>Be quiet</td>
<td>0.21</td>
</tr>
<tr>
<td>Total</td>
<td>0.70</td>
</tr>
</tbody>
</table>

(b) 0.48.

(c) This is a conditional probability:
\[
P(S|H) = \frac{P(SH)}{P(H)} = \frac{0.07/0.16}{0.438}.
\]
25. (a) A false positive means \((A^cB)\); thus, the answer is \(217/3400 = 0.064\).

(b) A correct test result is either a correct positive \((AB)\) or a correct negative \((A^cB^c)\). Thus, the answer is 
\[
\frac{2741}{(395 + 2741)} = \frac{2741}{3136} = 0.874.
\]

(c) The answer is \(395/612 = 0.645\).

(d) The answer is \(47/2788 = 0.017\).

(e) The answer is \(442 + 2741 = 3183\) \(3400 = 0.936\).

26. (a) The estimate of the mean is 
\[
\bar{x} + \bar{y} = 240 + 230 = 470.
\]
The estimated variance is 
\[
(65)^2 + (58)^2 + 2(0.40)(65)(58) = 10605.
\]
Thus, the estimated standard error is 
\[
\sqrt{10605} = 102.98.
\]
Next, \(df = n - 1 = 12 - 1 = 11\). Thus, the \(t^*\) for 95% is 2.201. The 95% CI is 
\[
470 \pm 2.201(102.98/\sqrt{12}) = 470 \pm 65.43.
\]

(b) All that will change is the estimated variance:
\[
(65)^2 + (58)^2 + 2(-0.40)(65)(58) = 4573.
\]
Thus, the estimated standard error is 
\[
\sqrt{4573} = 67.62.
\]
The 95% CI is 
\[
470 \pm 2.201(67.62/\sqrt{12}) = 470 \pm 42.96.
\]

27. (a) For 95% confidence, we have 
\[
k' = \frac{49 + 1}{2} - \frac{1.96\sqrt{49}}{2} = 25 - 6.86 = 18.14.
\]
Thus, \(k = 18\) and the CI extends from the 18th smallest observation to the 18th largest observation:
\[
[365, 426].
\]

(b) By inspecting the list of data, we see that 360 is the 15th smallest observation. Thus, \(k = 15\) and the upper bound is the 15th largest observation, 432.

(c) From (a), the CI for \(k = 18\) has width equal to \(426 - 365 = 61\); i.e., it is too wide for Skyline’s. I resort to trial-and-error. I try \(k = 20\) and obtain the interval \([369, 423]\), which is too wide. Next, I try \(k = 22\) and obtain the interval \([387, 420]\), which is too narrow. Following the lead of my friend Goldilocks, I realize that \(k = 21\) must be correct; it gives the interval \([375, 422]\), which, indeed, has a width of 47.

(d) I attempted to trick you with the manner in which I wrote the PI. First, write it as \([306, 514]\). From the listing of the data, we see that 306 is the fourth smallest data point and 514 is the fourth largest. Thus, I used the PI with \(k = 4\). Per our formula, the level of the PI is 
\[
1 - \frac{2(4)49 + 1}{49} = 1 - 0.16 = 0.84,
\]
or 84%. 

28. Nancy shoots 300 pairs of free throws; Nancy’s data are presented below.

<table>
<thead>
<tr>
<th>First Shot</th>
<th>Second Shot</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td>65</td>
<td>70</td>
</tr>
<tr>
<td>130</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>135</td>
</tr>
</tbody>
</table>

(a) This is an example of the use of the CI for \([P(A) - P(B)]\) for paired data.

\[
\frac{70 - 130}{300} \pm \frac{1.96}{300} \sqrt{\frac{300(200) - 60^2}{299}} = -0.200 \pm 0.090.
\]

(b) We are now assuming a Chapter 15 problem which means that we present the data as follows:

<table>
<thead>
<tr>
<th>Shot</th>
<th>Outcome</th>
<th>S</th>
<th>F</th>
<th>Total</th>
<th>(\hat{p})</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>S</td>
<td>135</td>
<td>165</td>
<td>300</td>
<td>0.450</td>
</tr>
<tr>
<td>Second</td>
<td>F</td>
<td>195</td>
<td>105</td>
<td>300</td>
<td>0.650</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>330</td>
<td>270</td>
<td>600</td>
<td></td>
</tr>
</tbody>
</table>

The CI is \((0.450 - 0.650)\pm1.96\sqrt{\frac{0.45(0.55) + 0.65(0.35)}{300}} = -0.200 \pm 0.078.

(c) This was a trick question. Most students answered “Analysis (b) is better because its CI is narrower.” If you look at Nancy’s paired data, however, you see that she had a 48% (65 of 135) success rate after a success and a 79% (130 of 165) success rate after a failure. Even without performing Fisher’s test (the exact P-value for the two-sided alternative is \(3.47 \times 10^{-8}\)) we can see that the assumption behind (b) is grossly contradicted by the data. Thus, the correct answer is (a).

29. (a) CIs 1, 2 and 3 are correct for \(\mu = 60.0\).

(b) Only CI 1 is too small for \(\mu = 63.0\).

(c) CIs 3, 4 and 5 are too large for \(\mu = 52.0\).

(d) Given that interval 3 is correct, then interval 4 must also be correct because interval 3 is contained in (is a subset of) interval 4.