6.36 A series of patients with bacterial wound infections were treated with the antibiotic Cefotaxime. Bacteriologic response (disappearance of the bacteria from the wound) was considered satisfactory in 84% of the patients. Determine the standard error of the observed proportion of satisfactory responses if the series contain
(a) 50 patients (b) 200 patients
Solution: (a) \( y = 50 \times 0.84 = 42 \); \( \hat{p} = \frac{y + 2}{n + 4} = \frac{42 + 2}{50 + 4} = 0.815 \). \( \text{SE} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n+4}} = \sqrt{\frac{0.815(1-0.815)}{50+4}} = 0.053 \)
(b) \( y = 200 \times 0.84 = 168 \); \( \hat{p} = \frac{y + 2}{n + 4} = \frac{168 + 2}{200 + 4} = 0.833 \) \( \text{SE} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n+4}} = \sqrt{\frac{0.833(1-0.833)}{200+4}} = 0.026 \)

6.41 Researchers tested patients with cardiac pacemakers to see if use of a cellular telephone interferes with the operation of the pacemaker. There were 959 tests conducted for one type of cellular telephone; interference with the pacemaker was found in 15.7% of these tests.
(a) Use these data to construct an appropriate 95% confidence interval.
(b) The confidence interval from part (a) is a confidence interval for what quantity? Answer in the context of the setting.
Solution:
(a) \( y = 959 \times 0.157 = 150.56 \), so \( y \) must be 151. Thus \( \hat{p} = \frac{y + 2}{n + 4} = \frac{151 + 2}{959 + 4} = 0.159 \) \( \text{SE} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n+4}} = \sqrt{\frac{0.159(1-0.159)}{959+4}} = 0.0118 \) 95% confidence interval: \( 0.159 \pm 1.96 \times 0.0118 \) or \( (0.136, 0.182) \)
(b) The confidence interval from part (a) is a confidence interval for the probability of interference with the pacemaker for that type of cellular telephone.

6.48 A group of 1,438 sexually active patients were counseled on condom use and the risk of contracting a sexually transmitted disease (STD). After six months 103 of the patients had new STDs. Construct a 95% confidence interval for the probability of contracting an STD within six months after being part of a counseling program like the one used in this study.
Solution: \( \hat{p} = \frac{y + 2}{n + 4} = \frac{103 + 2}{1438 + 4} = 0.073 \) \( \text{SE} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n+4}} = \sqrt{\frac{0.073(1-0.073)}{1438+4}} = 0.0069 \) 95% confidence interval: \( 0.073 \pm 1.96 \times 0.0069 \) or \( (0.059, 0.087) \)

7.11 Freulic acid is a compound that may play a role in disease resistance in corn. A botanist measured the concentration of soluble freulic acid in corn seedlings grown in the dark or in a light/dark photoperiod. The results were as shown in the table.

<table>
<thead>
<tr>
<th></th>
<th>Dark</th>
<th>Photoperiod</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n )</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>mean</td>
<td>92</td>
<td>115</td>
</tr>
<tr>
<td>SD</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

Office hours: T 9:30-10:30 and F 11:00-12:00 at 1276 MSC http://www.stat.wisc.edu/~qitang
Construct
(a) a 95% confidence interval (b) a 90% confidence interval
for the difference in ferulic acid concentration under the two lighting conditions. Note: formula (7.1) yields 6 degrees of freedom for these data.
Solution: Let 1 denote dark and let 2 denote photoperiod
\[
SE_{\hat{y}_1 - \hat{y}_2} = \sqrt{\frac{13^2}{4} + \frac{13^2}{4}} = 9.192
\]
So the 95% confidence interval is (92-115)± 2.447*9.192 or (-45.5, -0.5). The 90% confidence interval is (92-115)± 1.943*9.192 or (-40.9, -5.1).

7.19 The data in the following table show the change in heart rate; a positive number means that heart rate went up and a negative number means that that heart rate went down:

<table>
<thead>
<tr>
<th></th>
<th>Caffeine</th>
<th>Decaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>mean</td>
<td>7.3</td>
<td>5.9</td>
</tr>
<tr>
<td>SD</td>
<td>11.1</td>
<td>11.2</td>
</tr>
<tr>
<td>SE</td>
<td>3.7</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Use these data to construct a 90% confidence interval for the difference in mean affect that caffeinated coffee has on heart rate, in comparison to decaffeinated coffee. Note formula (7.1) yields 17.3 degrees of freedom for this data.

Solution: Let 1 denote caffeine and let 2 denote decaf
\[
SE_{\hat{y}_1 - \hat{y}_2} = \sqrt{\frac{3.7^2}{3} + \frac{3.4^2}{4}} = 5.02
\]
(7.3-5.9)± 1.740*5.02 (using df= 17) or (-7.33, 10.13)
For normal plots, from figure 1, we can see "caffeine"and "decaf" are normal, t-test is valid here.

7.31 In a study of the development of the thymus gland, researchers weighted the glands of 10 chick embryos. Five out of the embryos had been incubated 14 days and five had been incubated 15 days. The thymus weight were as shown in the table.

<table>
<thead>
<tr>
<th>Thymus Weight (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 days</td>
</tr>
<tr>
<td>n</td>
</tr>
<tr>
<td>mean</td>
</tr>
<tr>
<td>SD</td>
</tr>
</tbody>
</table>

(a) Use a t test to compare the means at \( \alpha = 0.10 \)
(b) Note that chicks that were incubated longer had a smaller mean thymus weight. Is this “backward” result surprising, or could it be attributed to chance? Explain.

Solution: (a) \( H_0 \): mean thymus weight is the same at 14 and 15 days (\( \mu_1 = \mu_2 \))
\( H_A \): mean thymus weight is not the same at 14 and 15 days (\( \mu_1 \neq \mu_2 \))
Figure 1: Normal plots for 7.19

\[ SE(\overline{y}_1 - \overline{y}_2) = \sqrt{\frac{8.73^2}{5} + \frac{7.19^2}{5}} = 5.06 \]

\[ t_s = \frac{(31.72 - 29.22)}{5.06} = 0.49 \]

We round the df to 8 and from the t-distribution table (on the back of the textbook) we know \( t_s < 0.889 \). So \( t_s < t_{0.20} \), we know that P-value > 2 * 0.20 = 0.4 > 0.1 = \( \alpha \), so we don’t reject \( H_0 \).

(b) According to the P-value found in part (a), the fact that \( \overline{y}_1 \) is greater than \( \overline{y}_2 \) could easily be attributed to chance.