1. Testing has shown that a new washing machine has a length of life that is normally distributed with mean equal to 5.10 years and a standard deviation equal to 1.54 years. If the washers are guaranteed for 2 years, what percentage will fail before the end of the guarantee time?

2. Automotive engineers are continually improving their products. Suppose a new type of brake light has been developed by General Motors. As part of a product safety evaluation program, General Motors’ engineers wish to estimate the mean driver response time to the new brake light. (Response time is the length of time from the point that the brake is applied until the driver in the following car takes some corrective action.) It is believed that the population variance for response time is 0.022 seconds. Fifty drivers are selected at random and the response time for each driver is recorded, yielding a mean of 0.72 seconds. Estimate the mean driver response time to the new brake light using a 99% confidence interval. Can we conclude that the true mean driver response time is 1.05 seconds based on the confidence interval?

3. The application of adrenalin is the prevailing treatment to reduce eye pressure in glaucoma patients. Theoretically, a new synthetic drug will cause the same mean drop in pressure (5.5 units) without the side effects caused by adrenalin. The new drug is given to five glaucoma patients and the reductions in eye pressure for the patients are 4.0, 3.8, 5.7, 5.3, and 4.6 units. Do the data above provide sufficient evidence to indicate that the mean reduction in eye pressure due to the new drug is different from that produced by adrenalin?

4. Your statistics professor tells you that the distribution of scores on a midterm exam was approximately normal with a mean of 78. The top 15% of all scores have been designated as A’s (score of 85). Using this information, what was the standard deviation on this exam?

5. A manufacturer of small appliances purchases plastic handles for coffeepots from an outside vendor. If a handle is cracked, it is considered defective and must be discarded. A very large shipment of plastic handles is received. The proportion of defective handles is of interest. How many handles from the shipment should be inspected to estimate P to within 0.1 with 95% confidence?

6. A Roper poll of 2000 American adults showed that 1440 thought that chemical dumps are among the most serious environmental problems. Estimate with a 98% confidence interval the proportion of the population who consider chemical dumps among the most serious environmental problems.

7. A woman has made a daily record of the length of time it takes to travel from her house to her place of work. The distribution is approximately normal, with a mean of 20 minutes and a standard deviation of 2.1 minutes. How long before she is to start working should she leave so that she is late only 10% of the time?
8. The article “So Close, Yet So Far: Predictors of Attrition in College Senior” attempts to describe differences between college seniors who disenroll before graduating and those who do graduate. Researchers randomly selected 42 non-returning and 48 returning seniors, none of whom were transfer students. These 90 students rated themselves on personal contact and campus involvement. The resulting data is summarized here:

<table>
<thead>
<tr>
<th></th>
<th>RETURNING</th>
<th></th>
<th>NON-RETURNING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Personal Contact</td>
<td>3.22</td>
<td>0.93</td>
<td>2.41</td>
<td>1.03</td>
</tr>
<tr>
<td>Campus Involvement</td>
<td>3.21</td>
<td>1.01</td>
<td>3.31</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Construct a 95% confidence interval for the difference in mean campus involvement rating for returning and non-returning students. Does your interval support the statement that students who do not return are less involved, on average, than those who do return?

9. The manager at Air Express feels that the weights of packages shipped recently are less than in the past. Records show that in the past packages have had a mean weight of 36.7 lb and a standard deviation of 14.2 lb. A random sample of last month’s shipping records yielded a mean weight of 32.1 lb for 64 packages. Is this sufficient evidence to reject the null hypothesis in favor of the manager’s claim? Use a 1% level of significance.

10. The number of violent crimes per day in a particular city possesses a mean equal to 1.3 and a standard deviation equal to 1.7. A random sample of 50 days is observed, and the daily mean number of crimes for this sample is calculated. What is the approximate probability that the sample mean will be greater than 1.9?

11. An important problem facing strawberry growers is the control of nematodes. These organisms compete with the plants for nutrients in the soil, thereby reducing yield. For this reason, fumigation is normally a part of field preparation. Recently, a new fumigant has been developed. It is applied to six standard plots of strawberries, and the yield of marketable fruit (in pounds) for each plot is 9, 9, 13, 9, 10, 8. Construct a 95% confidence interval for the true mean yield of marketable fruit after using the new fumigant.

12. Do students tend to improve their SAT Mathematics (SAT-M) score the second time they take the test? A random sample of four students who took the test twice received the following scores:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>450</td>
<td>520</td>
<td>720</td>
<td>600</td>
</tr>
<tr>
<td>Second</td>
<td>440</td>
<td>600</td>
<td>720</td>
<td>630</td>
</tr>
</tbody>
</table>

Find a 95% confidence interval for the difference in the mean scores.

13. The Wall Street Journal (2/15/72) reported that General Electric was being sued in Texas for sex discrimination because of a minimum height requirement of 5 ft. 7 in. The suit claimed that this restriction eliminated more than 94% of adult’s females from consideration. Suppose that the probability distribution of the height of a randomly selected adult woman is approximately normal with a standard deviation of 2 in. Based on this information, what is the population mean?

14. The purchasing department for a regional supermarket chain is considering two sources from which to purchase 10-lb bag of potatoes. A random sample taken from each source shows the following results:

<table>
<thead>
<tr>
<th>Number of Bags Weighed</th>
<th>Idaho Supers</th>
<th>Idaho Best</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Mean Weight (in lbs) 10.2 10.4
Sample Variance 0.36 0.25

At the 5% level of significance, is there a difference between the mean weights of the 10-lb bags of potatoes?

15. A psychologist hired by the National Football League wishes to estimate the true mean number of days spent away from home by professional football players during a year. Past records indicate that the distribution of the number of days spent away from home has a standard deviation of 10 days. How many professional football players should be included in the sample if the researcher wishes to be 90% confidence that the estimate is within 2 days of the true value of the mean?

16. To investigate the relationship between yield of potatoes, \( y \), and level of fertilizer application, \( x \), an experimenter divided a field into eight plots of equal size and applied differing amounts of fertilizer to each. The yield of potatoes (in pounds) and the fertilizer application (in pounds) were recorded for each plot. The data are shown below:

\[
\begin{array}{cccccccc}
 x & 2 & 1.5 & 2 & 2.5 & 3 & 3.5 & 4 & 4.5 \\
 y & 25 & 31 & 27 & 28 & 36 & 35 & 32 & 34 \\
\end{array}
\]

a) Determine the correlation

b) Find the least squares prediction line

c) According to your least squares line, approximately how many pounds of potatoes would you expect from a plot to which 3.75 pounds of fertilizer had been applied?

17. In a small city, approximately 15% of those eligible are called for jury duty in any one calendar year. People are selected for jury duty at random from those eligible, and the same individuals can’t be called more than once in the same year. What is the probability that an eligible person in this city is selected two years in a row? Three years in a row?

18. Suppose that the accompanying information in births in the United States over a given period of time is available to you.

<table>
<thead>
<tr>
<th>Type of Birth</th>
<th># of Births</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Birth</td>
<td>41,500,000</td>
</tr>
<tr>
<td>Twins</td>
<td>500,000</td>
</tr>
<tr>
<td>Triplets</td>
<td>5,000</td>
</tr>
<tr>
<td>Quadruplets</td>
<td>100</td>
</tr>
</tbody>
</table>

a) What is the probability that a randomly selected pregnant woman who reaches full term delivers twins?

b) What is the probability that a randomly selected pregnant woman who reaches full term gives birth to more than a single child?
19. The new Endeavor SUV has been recalled because 5% of the cars experienced brake failure. The Tahoe dealership has sold 200 of these cars. What is the probability that fewer than 4% of the cars from Tahoe experience brake failure?

20. Many researchers have investigated the relationship between stress and reproductive efficiency. Seven rams were used in a study and LH (luteinizing hormone) release was recorded before and after treatment with ACTH (adrenocorticotrophin, a drug that results in stimulation of the adrenal gland).

<table>
<thead>
<tr>
<th>Ram</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Before</strong></td>
<td>2400</td>
<td>1400</td>
<td>1375</td>
<td>1325</td>
<td>1200</td>
<td>1150</td>
<td>850</td>
</tr>
<tr>
<td><strong>After</strong></td>
<td>2250</td>
<td>1425</td>
<td>1100</td>
<td>800</td>
<td>850</td>
<td>925</td>
<td>700</td>
</tr>
</tbody>
</table>

At a 1% significance level, can we conclude that there is a significant reduction in the mean LH release following treatment with ACTH?
REVIEW SOLUTIONS

1. \( Z = \frac{2 - 5.1}{1.54} = -2.01 \quad P(X < 2) = 0.0222 \)

2. \( 0.72 \sqrt{\frac{2.575}{50}} \sqrt{\frac{0.022}{50}} = 0.72 \sqrt{0.05} \quad \) I’m 99% confident (0.67, 0.77) contains \( m \)
   No, \( m \not\in 1.05 \) since that value is not in the interval.

3. \( H_0: m = 5.5 \) vs \( H_a: m \neq 5.5 \)
   \( t = \frac{4.68 - 5.5}{0.82/\sqrt{5}} = -2.24 \quad df = 4 \)
   \( 2*|0.025 < p-value < 0.05| = 0.05 < p-value < 0.1 \quad \) Don’t Reject \( H_0 \) since \( p-value \) is greater than \( \alpha \).

4. \( 1.04 = \frac{85 - 78}{\sigma} \quad s = 6.7 \)

5. \( n = \frac{|1.96|^2 * 0.5 * 0.5}{|0.1|^2} = 96.04 \quad n = 97 \)

6. \( \frac{1440}{2000} \pm (2.33) \sqrt{0.72 * 0.28 / 2000} \quad 0.72 \pm 0.02 \quad I’m 98\% \text{ confident (0.7, 0.74) contains } P \)

7. \( 1.28 = \frac{x - 20}{2.1} \quad x = 22.7 \)

8. \( [3.31, 3.34] \pm 2.021 \sqrt{\frac{|1.01|^2}{48} - \frac{|1.03|^2}{42}} \quad 0.1 \ 0.4 \quad I’m 95\% \text{ confident (-0.3, 0.5) contains } \mu_R - \mu_N \). NO, since zero is contained in the interval, the means are equal.

9. \( H_0: m = 36.7 \) vs \( H_a: m < 36.7 \)
   \( Z = \frac{32.1 - 36.7}{14.2 / \sqrt{64}} = -2.59 \quad p-value = 0.0048 \)
   Reject \( H_0 \) since \( p-value < \alpha = 0.01 \).

10. \( P(\bar{x} > 1.9) = P(z > \frac{1.9 - 1.3}{1.7/\sqrt{50}}) = P(z > 2.50) = 0.0062 \)

11. \( 9.7 \pm 2.571 * 1.75 / \sqrt{6} \quad \Rightarrow \ 9.7 \pm 1.8 \quad I’m 95\% \text{ confident (7.9, 11.5) contains } m \)

12. \( -25 \pm 0.182 * \frac{40.4}{\sqrt{4}} \quad I’m 95\% \text{ confident (-89.2, 39.2) contains } m \). Since zero is in the interval, there is no significant change in the mean score.
13. \[ \frac{67 - m}{2} = \mu = 63.9 \text{ inches} \Rightarrow 5 \text{ ft 3.9 inches} \]

14. \[ \begin{align*}
H_0 : m - \bar{m} &= 0 \text{ vs } H_a : m - \bar{m} \neq 0 \\
&= \frac{10.4 - 10.2}{0.36 + 0.25} = 2.56 \\
df &= 99 \text{ use } df = 100 \\
2*(0.005 < p - value < 0.01) &= 0.01 < p - value < 0.02 < a = 0.05 \\
\text{Reject } H_0. \text{ There is a significant difference in the mean weights.}
\end{align*} \]

15. \[ n = \frac{645*10}{2} = 67.7 \Rightarrow n = 68 \]

16. \[ r = \frac{732 - 8*2.875*31}{7*1.06*4} = 0.64 \text{ \hspace{1cm}} \text{slope} = \frac{0.64*4}{1.06} = 2.42 \]

\[ y - \text{int} = 31 - 2.42*2.875 = 24.04 \]
\[ \hat{y} = 2.42*3.75 + 24.04 = 33.12 \text{ pounds when 3.75 pounds of fertilizer is used} \]

17. \[ P(2 \text{ years in a row}) = \left(0.15\right)^2 = 0.0225 \text{ \hspace{1cm}} P(3 \text{ years in a row}) = \left(0.15\right)^3 = 0.0034 \]

18. \[ P(\text{twins}) = \frac{500,000}{42,005,100} = 0.012 \]

\[ P(\text{more than a single child}) = 1 - P(\text{single birth}) = 1 - \frac{41,500,000}{42,005,100} = 0.012 \]

19. \[ np_o = 200*.05 = 10 \text{ \hspace{1cm}} \text{Normal} \]

\[ p\left| \hat{p} < 0.04 \right| = p\left| \frac{0.04 - 0.05}{0.05*0.95} \right| = p\left| Z < -0.65 \right| = 0.2578 \]

20. \[ H_0 : \mu_d = 0 \text{ \hspace{1cm}} H_a : \mu_d > 0 \]

\[ t = \frac{235.7 - 0}{173.7/\sqrt{7}} = 3.59 \text{ \hspace{1cm}} df = 6 \]

\[ 0.005 < p - value < 0.01 = a \text{ \hspace{1cm}} \text{Reject } H_0. \mu_d > 0 \]

Yes, there is a significant reduction in the mean LH release following treatment with ACTH.