1. Cholesterol levels for men are normally distributed with \( \mu \approx 190 \). But a sampling of 16 men gave \( \bar{x} = 184 \) with \( S = 12 \).

Is there evidence, with level of significance \( \alpha = 0.05 \), to conclude that the mean cholesterol level for men differs from 190?

(a) State the null hypothesis and a one-sided alternative, and explain what test to use.

\[ H_0 : \mu = 190 \quad \text{vs.} \quad H_a : \mu < 190 \quad (\text{because } \bar{x} < 190) \]

We use a T-Test because we have a normally distributed measurement but we don’t have a known \( \sigma \).

(b) Use the table below to find the endpoint of the rejection region for your one-sided test in Part (a). Show it on a shaded graph and state the distribution curve used.

<table>
<thead>
<tr>
<th>deg. of fr.</th>
<th>0.90</th>
<th>0.95</th>
<th>0.98</th>
<th>0.99</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>1.753</td>
<td>2.131</td>
<td>2.602</td>
<td>2.947</td>
</tr>
<tr>
<td>16</td>
<td>1.746</td>
<td>2.120</td>
<td>2.583</td>
<td>2.921</td>
</tr>
<tr>
<td>17</td>
<td>1.740</td>
<td>2.110</td>
<td>2.567</td>
<td>2.898</td>
</tr>
</tbody>
</table>

\( n = 16 \) Use \( t(15) \) curve

\( \alpha = 0.05 \Rightarrow -1.753 \)

(c) Use the \( P \)-value to explain your conclusion with \( \alpha = 0.05 \).

The \( P \)-value of about 0.032 is less than \( \alpha = 0.05 \). So there is strong enough evidence to reject \( H_0 \) with \( \alpha = 0.05 \).

(d) Show how to find the test statistic used for your test in Part (a). Explain the conclusion in terms of the test statistic.

\[ t = \frac{\bar{x} - \mu}{S/\sqrt{n}} = \frac{184 - 190}{12/\sqrt{16}} = -2 \]

The test statistic \( t = -2 \) is in the rejection beyond \(-1.753\). So there is enough evidence to reject \( H_0 \).
2. Cholesterol levels among women are also normally distributed with $\mu \approx 170$. A sampling of 20 women gave $\bar{x} = 171$ with $S = 14.6$.

Is there evidence, with level of significance $\alpha = 0.05$, to conclude that the mean cholesterol level for women differs from 170?

(a) State the null hypothesis and a one-sided alternative, and explain what test to use.

$$H_0: \mu = 170 \quad \text{vs.} \quad H_a: \mu > 170 \quad \text{(because} \quad \bar{x} > 170)$$

We use a T-Test because we have a normally distributed measurement but we don't have a known $\sigma$.

(b) Use the table below to find the endpoint of the rejection region for your one-sided test in Part (a). Show it on a shaded graph and label the distribution used.

<table>
<thead>
<tr>
<th>deg. of fr</th>
<th>0.90</th>
<th>0.95</th>
<th>0.98</th>
<th>0.99</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>1.734</td>
<td>2.101</td>
<td>2.552</td>
<td>2.878</td>
</tr>
<tr>
<td>19</td>
<td>1.729</td>
<td>2.093</td>
<td>2.539</td>
<td>2.861</td>
</tr>
<tr>
<td>20</td>
<td>1.725</td>
<td>2.086</td>
<td>2.528</td>
<td>2.845</td>
</tr>
</tbody>
</table>

$n = 20$ Use $t(19)$ curve

(c) Use the $P$-value to explain your conclusion.

The $P$-value of 0.38 is more than $\alpha = 0.05$. The high $P$-value means that there is not enough evidence to reject $H_0$ with $\alpha = 0.05$.

(d) Show how to find the test statistic used for your test in Part (a). Explain the conclusion in terms of the test statistic.

$$t = \frac{\bar{x} - \mu}{S} \cdot \frac{1}{\sqrt{n}} = \frac{171 - 170}{14.6} / \sqrt{20} = 0.30631$$

For $\alpha = 0.05$, the test statistic of $t = 0.30631$ is not in the rejection beyond 1.729. So there is not enough evidence to reject $H_0$. 

3. Baby birth weights are normally distributed with $\mu \approx 7$ lbs and $\sigma = 2$ lbs. A sampling of 30 newborns gave $\bar{x} = 6.95$ with $S = 1.95$.

Is there evidence, with level of significance $\alpha = 0.05$, to conclude that the mean baby birth weight differs from 7 lbs?

(a) State the null hypothesis and a one-sided alternative, and explain what tests can be used.

$$H_0 : \mu = 7 \hspace{1em} \text{vs.} \hspace{1em} H_a : \mu < 7 \hspace{1em} \text{(because} \hspace{0.5em} \bar{x} < 7)$$

We can use a T-Test because we have a normally distributed measurement. Here we would use the sample deviation $S$.

We also can use a Z-Test because we have a normally distributed measurement with a known $\sigma$. Because $\sigma$ is known, it is better to use this Z-Test.

(b) Use a $P$-value to explain your conclusion.

The high $P$-value of 0.4455 means that there is no enough evidence to reject $H_0$. 

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