1. Null hypothesis $H_0: \mu = 73.2$

   Alternative hypothesis $H_1: \mu > 73.2$

2. Level of significance: $\alpha = 0.01$.

3. Criterion: Using a normal approximation for the distribution of the sample mean, we reject the null hypothesis when

   $$Z = \frac{\bar{X} - \mu_0}{\sigma / \sqrt{n}} > z_\alpha.$$ 

   Since $\alpha = .01$ and $z_{.01} = 2.33$, the null hypothesis must be rejected if $Z > 2.33$.

4. Calculations: $\mu_0 = 73.2$, $x = 76.7$, $\sigma = 8.6$, and $n = 45$ so

   $$Z = \frac{76.7 - 73.2}{8.6 / \sqrt{45}} = 2.73$$

5. Decision: Because $2.73 > 2.33$, the null hypothesis that $\mu = 73.2$ is rejected.

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7.43 1. Null hypothesis $H_0: \mu = 32.6$

   Alternative hypothesis $H_1: \mu > 32.6$

2. Level of significance: $\alpha = 0.05$.

3. Criterion: Since the sample is large, we use the normal approximation to the distribution of the mean. We reject the null hypothesis when

   $$Z = \frac{\bar{X} - \mu_0}{S / \sqrt{n}} > z_\alpha.$$ 

   Since $\alpha = .05$ and $z_{.05} = 1.645$, the null hypothesis must be rejected if $Z > 1.645$. 
4. Calculations: \( \mu_0 = 32.6, \bar{x} = 33.8, s = 6.1, \) and \( n = 60 \) so

\[
z = \frac{33.8 - 32.6}{6.1/\sqrt{60}} = 1.52
\]

5. Decision: Because \( 1.52 < 1.645 \), we cannot reject the null hypothesis at the .05 level of significance.

7.44 1. Null hypothesis \( H_0 : \mu = 58,000 \)

Alternative hypothesis \( H_1 : \mu \neq 58,000 \)

2. Level of significance: \( \alpha = 0.05 \).

3. Criterion: Assuming the population is normal, we can use the \( t \) statistic

\[
t = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}
\]

Since the alternative hypothesis is two-sided, the critical region is defined by \( t < -t_{0.025} \) or \( t > t_{0.025} \) where \( t_{0.025} \) with 5 degrees of freedom is 2.571.

4. Calculations: In this case, \( \mu_0 = 58,000, \bar{x} = 58.392, s = 648, \) and \( n = 6 \) so

\[
t = \frac{58.392 - 58,000}{648/\sqrt{6}} = 1.48
\]

5. Decision: Because \( 1.48 < 2.571 \), we cannot reject the null hypothesis at the .05 level.
1. Null hypothesis $H_0: \mu = 14.0$

   Alternative hypothesis $H_1: \mu \neq 14.0$

2. Level of significance: $\alpha = 0.05$.

3. Criterion: Assuming the population is normal, we can use the $t$ statistic.

   $$t = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$$

   Since the alternative hypothesis is one-sided, the critical region is defined by $t < -t_{.025}$ or $t > t_{.025}$ where $t_{.025}$ with 4 degrees of freedom is 2.776.

5. Calculations: In this case, $\mu_0 = 14.0$, $n = 5$, $\bar{x} = 14.4$ and $s = .158$ so

   $$t = \frac{14.4 - 14.0}{.158/\sqrt{5}} = 5.66.$$  

5. Decision: Because 5.66 > 2.776, we reject the null hypothesis in favor of the alternative hypothesis $\mu \neq 14.0$ at the .05 level of significance. From the $t$-table, the $P$-value is less than .005. A computer program gives the $P$-value in the figure.

7.49 We are testing the null hypothesis $H_0: \mu = 14.0$ against the alternative $H_1: \mu \neq 14.0$ at the .05 level of significance. The critical region is defined by $t < -t_{.025}$ or $t > t_{.025}$ where $t_{.025}$ with 4 degrees of freedom is 2.776. With the first value changed, $\bar{x} = 14.7$ and $s = .74162$ so

   $$t = \frac{14.7 - 14.0}{.74162/\sqrt{5}} = 2.11.$$  

   and we cannot reject the null hypothesis. The "paradox" is explained by the standard deviation, which has greatly increased.