Solution Bank



Exercise 4D

$$1 \quad Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$
$$= \frac{21.2 - 21}{\frac{1.5}{\sqrt{20}}}$$
$$= 0.596$$

 $0.596 \le 1.96$ therefore not significant. H_0 accepted (two tail 5%).

2
$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

= $\frac{98.5 - 100}{\frac{5}{\sqrt{36}}}$
= -1.8
-1.8 < -1.645

1.8 > 1.645 therefore significant. H_0 rejected (one tail 5%).

3
$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$
$$= \frac{6.1 - 5}{\frac{3}{\sqrt{25}}}$$
$$= 1.83$$

1.83 < 1.96 therefore not significant. H₀ accepted (two tail 5%).

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4
$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$
$$= \frac{16.5 - 15}{\frac{3.5}{\sqrt{40}}}$$
$$= 2.71$$

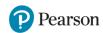
2.71 > 1.645 therefore significant. H₀ rejected (one tail 5%).

5
$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

= $\frac{48.9 - 50}{\frac{4.0}{\sqrt{60}}}$
= -2.13
-2.13 < -1.96
2.13 > 1.96 therefore significant.
H₀ rejected (two tail 5%).

6
$$\frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}} < -1.645$$
 $\frac{\overline{X} - 120}{\frac{2}{\sqrt{30}}} < -1.645$
 $\overline{X} - 120 < -1.645 \times \frac{2}{\sqrt{30}}$
 $\overline{X} < 120 - 1.645 \times \frac{2}{\sqrt{30}}$
 $\overline{X} < 119.399$

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 $\frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{n}}} > 2.326$ $\frac{\bar{X} - 12.5}{\frac{1.5}{\sqrt{25}}} > 2.326$ $\bar{X} - 12.5 > 2.326 \times \frac{1.5}{\sqrt{25}}$

$$\overline{X} > 12.5 + 2.326 \times \frac{\sqrt{25}}{\sqrt{25}}$$

$$\bar{X} > 13.198$$

8
$$\frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}} < -1.282$$
 $\frac{\overline{X} - 85}{\frac{4}{\sqrt{50}}} < -1.282$
 $\overline{X} - 85 < -1.282 \times \frac{4}{\sqrt{50}}$
 $\overline{X} < 85 - 1.282 \times \frac{4}{\sqrt{50}}$
 $\overline{X} < 84.275$

9
$$-1.96 > \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}} > 1.96$$

 $-1.96 \times \frac{3.0}{\sqrt{45}} > \overline{X} > 1.96 \times \frac{3.0}{\sqrt{45}} - 1.96 > \frac{\overline{X} - 0}{\frac{3.0}{\sqrt{45}}} > 1.96$
 $-0.877 > \overline{X} > 0.877$
 $\overline{X} > 0.877$ and $\overline{X} < -0.877$

Solution Bank



10

$$2.576 < \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}} > -2.576$$

$$2.576 < \frac{\overline{X} - (-8)}{\frac{1.2}{\sqrt{20}}} > -2.576$$

$$2.576 \times \frac{1.2}{\sqrt{20}} < \overline{X} + 8 > -2.576 \times \frac{1.2}{\sqrt{20}}$$

$$-8 + 2.576 \times \frac{1.2}{\sqrt{20}} < \overline{X} > -8 + -2.576 \times \frac{1.2}{\sqrt{20}}$$

$$-7.309 < \overline{X} > -8.691$$

$$\overline{X} > -7.31 \text{ and } \overline{X} < -8.69$$

11 H₀:
$$\mu = 185$$

H₁: $\mu < 185$

$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$= \frac{179 - 185}{\frac{15}{\sqrt{25}}}$$

$$= -2$$

$$-2 < -1.645$$

2 > 1.645 therefore significant.

H₀ rejected (one tail 5%).

There is evidence that the new formula is an improvement.

12 H₀:
$$\mu = 100$$

H₁: $\mu > 100$

$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$= \frac{102.5 - 100}{\frac{15}{10}}$$

$$= 1.667$$

1.667 > 1.645 therefore significant.

H₀ rejected (one tail 5%).

There is evidence that eating chocolate improves the IQ score.

Solution Bank



13 H₀:
$$\mu = 9$$

H₁: $\mu \neq 9$

$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$$= \frac{8.95 - 9}{\frac{0.15}{\sqrt{30}}}$$

$$= -1.826$$

$$-1.826 > -1.960$$

1.826 < 1.960 therefore not significant.

H₀ accepted (two tail 5%).

There is no evidence of a change in diameter.