

① Mean sales per week exceed 42.5 per person.

$$H_0: \mu \geq 42.5$$

$$H_1: \mu < 42.5$$

$$n = 100$$

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n} = 44.63$$

t-statistic is used

$$t = \frac{\bar{X} - \mu}{S/\sqrt{n}} \quad \text{but } s = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n-1}} = 7.4395$$

$$t = \frac{44.63 - 42.5}{7.4395/\sqrt{100}} = 2.8631$$

t value from a significance level α of 0.05 = 1.660391

We therefore reject the hypothesis because t-statistic exceeds our value from the table.

Confidence level of 99%

$$\alpha \text{ level} = (1 - 99)/100 = 0.01$$

$$C.I = \bar{X} \pm t \times \frac{S}{\sqrt{n}}$$

$$= 44.63 \pm 2.5758 \times \frac{7.4395}{\sqrt{100}} = 44.63 \pm 1.9162$$

$$C.I = (42.71, 46.5462)$$

[at 99% confidence level, the mean sales per week lie between 42.71 and 46.5462]

The confidence interval is from a mean of 42.71 to 46.5462.

This tells us that we are ^{not} confident with the manager's claim that the mean is > 42.5 which lies within the confidence interval.

② $H_0: p < 0.55$

$$H_1: p > 0.55$$

$$\text{Actual } p \text{ from data} = 0.43$$

$$S = 0.495076$$

$$SE = 0.049508$$

$$Z_{\text{test}} = -2.11$$

$$p\text{-value} = 0.007931$$

$$\text{critical value} = 1.645$$

$$\alpha \text{ level} = 0.05$$

$$p\text{-value} = 0.0079$$

C.I

Confidence level of 99%
 $\alpha = 0.01$

$$C.I = 0.43 \pm 0.1275 = (0.5575, 0.3025)$$

$$= (0.3025, 0.5575)$$

We do not have enough evidence to accept the hypothesis since $p\text{-value} < \alpha \text{ level of } 0.05$

- ③ Mean calls made ≥ 145
 $H_0: \mu \geq 145$
 $H_1: \mu < 145$

$$n = 100$$

$$\bar{X} = 160.33 = \frac{\sum_{i=1}^n X_i}{n} = \frac{1}{n} \sum_{i=1}^n X_i$$

$$S = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2} = 19.2643 = 19.2643$$

We therefore use t-statistic

$$t\text{-statistic} = \frac{\bar{X} - \mu}{S/\sqrt{n}} = \frac{160.33 - 145}{19.2643/\sqrt{100}} = \frac{15.33}{1.92643} = 7.9577$$

$$S.E = 1.92643$$

Critical value from statistical table = 1.660391

We do not have enough evidence to accept the null hypothesis because the t-statistic value exceeds our critical values at an α level of 5%.

$$\alpha\text{-level} = (1 - 0.99) = 0.01$$

$$\text{Confidence level} = 99\% = 0.99$$

$$C.I = \bar{X} \pm t \times \frac{S}{\sqrt{n}} = 160.33 \pm 1.92643$$

$$= (155.3681, 165.2919)$$

We are therefore 99% confident that no. of calls made mean lies between 155.3681 and 165.2919.

- ④ Mean time per call = 14.7

$$\mu = 14.7$$

$$\bar{X} = 14.947$$

$$\alpha\text{-level} = 0.05$$

critical value = (-1.9842, 1.9842) i.e. it is two-tailed

$$\text{Standard deviation } S = 2.3174$$

t-statistic

$$t = \frac{\bar{X} - \mu}{S/\sqrt{n}} = \frac{14.947 - 14.7}{2.3174/\sqrt{10}} = 2.1316 \text{ For single tail}$$

$$\text{For 2 tails} = \frac{2.1316}{2} = \pm 1.0658$$

We therefore do not have enough evidence to reject the hypothesis since the test statistic lies within the acceptance region.

$$\alpha\text{-level} = 1 - 0.99 = 0.01$$

$$\text{Confidence level} = 0.99$$

$$C.I = \bar{X} \pm t \times \frac{S}{\sqrt{n}}$$

$$= 14.947 \pm 2.626 \times \frac{2.3174}{\sqrt{10}}$$

$$C.I = 14.947 \pm 0.59692$$

$$= (14.35, 15.54)$$

We are therefore 99% confident that the mean time per call lies between 14.35 - 15.54 minutes