Student Information

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Answer 1

a)

$$\bar{X} = 7.8, n = 17, s = 1.4$$

$H_0 =$ If sample mean is equal to 7, customer service cannot be regarded as successful.

$H_A =$ If sample mean is greater than 7, customer service can be regarded as successful.

$$H_0 : \mu = 7$$
$$H_A : \mu > 7$$

Significance level is $a = 0.05$, so $t_c = 1.746$.

$$t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}} = \frac{7.8 - 7}{1.4/\sqrt{17}} = 2.356$$

Since $t = 2.356 > t_c = 1.746,$ null hypothesis is rejected.

So the customer service can be regarded as successful.

b)

We need to calculate a new mean when a customer who gave 10 mistakenly gives 1.

$$7.8 - \frac{10}{17} + \frac{1}{17} = 7.2706$$

Now we need to test same hypothesis with mean: 7.2706

$$t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}} = \frac{7.2706 - 7}{1.4/\sqrt{17}} = 0.7969$$

Since $t = 0.7969 < t_c = 1.746,$ alternate hypothesis is rejected.

So the customer service cannot be regarded as successful.

c)

We need to calculate a new mean if there are 45 customers in the survey.

$$7.8 - \frac{10}{45} + \frac{1}{45} = 7.556$$

Now we need to test same hypothesis with mean: 7.556 and n= 45

$$\begin{aligned} t &= \frac{\bar{X} - \mu_0}{s/\sqrt{n}} \\ &= \frac{7.556 - 7}{1.4/\sqrt{45}} \\ &= 2.664 \end{aligned}$$

Since $t = 2.664 > t_c = 1.746,$ null hypothesis is rejected.

So the customer service can be regarded as successful.

Yes, the mistake still affects the survey when we increase number of customers to 45. Because the difference of the mistake is so big (9) which have a significant effect on the survey.

d)

In all cases our mean is less than 8. Thus, we can conclude directly without making any calculations. Customer service cannot be regarded as successful.

Answer 2

$$\text{Sample Mean 1 } (\bar{X}_1) = 6.2$$
$$\text{Sample Standard Deviation 1}(s_1) \; = 1.5$$
$$\text{Sample Size 1 } (n_1) = 55$$
$$\text{Sample Mean 2 } (\bar{X}_2) = 5.8$$
$$\text{Sample Standard Deviation 1}(s_2) \; = 1.1$$
$$\text{Sample Size 2 } (n_2) = 55$$
$$\text{Significance Level}(\alpha) = 0.05$$
$$H_0 : \mu_1 = \mu_2$$
$$H_A : \mu_1 > \mu_2$$
$$t_c \text{ for } \alpha = 0.05 \text{ equals } 1.659.$$
$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1-1)\cdot s_1^2+(n_2-1)\cdot s_2^2}{n_1+n_2-2}(\frac{1}{n_1}+\frac{1}{n_2})}}$$
$$t = \frac{6.2 - 5.8}{\sqrt{\frac{55-1)\cdot 5^2+(55-1)\cdot(1.1)^2}{55+55-2}(\frac{1}{55}+\frac{1}{55})}} = 1.595$$
$$\text{Since } t = 1.595, t_c = 1.659, t \leq t_c.$$

Null hypothesis is not rejected. Therefore there is not enough evidence to claim that the population mean μ_1 is greater than μ_2, at $\alpha = 0.05$ significance level.

Answer 3

a)

$$\text{For Red Party's Candidate:}$$
$$\text{Sample Proportion P} = 48\% = 0.48$$
$$\text{Sample Size n} = 400$$
$$\text{Margin of Error} = Z^* \frac{P(1-P)}{n}.$$
$$Z^* \text{ for } \%95 \text{ confidence level is } 1.96.$$
$$\text{Margin of Error} = 1.96 \cdot \frac{(0.48) \cdot (0.52)}{400}$$
$$\text{Margin of Error of Red Party's Candidate} = 0.049$$
$$\text{For Blue Party's Candidate:}$$
$$\text{Sample Proportion P} = 37\% = 0.37$$
$$\text{Sample Size n} = 400$$
$$\text{Margin of Error} = Z^* \frac{P(1-P)}{n}.$$
$$Z^* \text{ for } \%95 \text{ confidence level is } 1.96.$$
$$\text{Margin of Error} = 1.96 \cdot \frac{(0.37) \cdot (0.63)}{400}$$
$$\text{Margin of Error of Blue Party's Candidate} = 0.0472$$

b)

$$\text{For Estimated Lead:}$$
$$\text{Sample Proportion P} = 11\% = 0.11$$
$$\text{Sample Size n} = 400$$
$$\text{Margin of Error} = 1.96 \cdot \frac{(0.11) \cdot (0.89)}{400}$$
$$\text{Margin of Error of Estimated Lead} = 0.031$$

c)

$$\text{Margin of Error of Red Party's Candidate} = 0.049$$
$$\text{Margin of Error of Blue Party's Candidate} = 0.0472$$

Red Party's Margin of Error is larger than Blue Party's Margin of Error. Hence their sample size and confidence levels are same, only difference here are their proportions. Since proportion of Red Party is greater than the Blue Party's proportion, Red Party's Margin of Error is higher than the Blue Party's Margin of Error.

d)

$$\text{For Red Party's Candidate:}$$
$$\text{Sample Proportion P} = 48\% = 0.48$$
$$\text{Sample Size n} = 1800$$
$$\text{Margin of Error} = Z^* \frac{P(1-P)}{n}.$$
$$Z^* \text{ for } \%95 \text{ confidence level is } 1.96.$$
$$\text{Margin of Error} = 1.96 \cdot \frac{(0.48)\cdot(0.52)}{1800}$$
$$\text{New Margin of Error of Red Party's Candidate} = 0.023$$
$$\text{For Blue Party's Candidate:}$$
$$\text{Sample Proportion P} = 37\% = 0.37$$
$$\text{Sample Size n} = 1800$$
$$Z^* \text{ for } \%95 \text{ confidence level is } 1.96.$$
$$\text{Margin of Error} = 1.96 \cdot \frac{(0.37)\cdot(0.63)}{1800}$$
$$\text{New Margin of Error of Blue Party's Candidate} = 0.022$$
$$\text{For Estimated Lead:}$$
$$\text{Sample Proportion P} = 11\% = 0.11$$
$$\text{Sample Size n} = 1800$$
$$\text{Margin of Error} = 1.96 \cdot \frac{(0.11)\cdot(0.89)}{1800}$$
$$\text{New Margin of Error of Estimated Lead} = 0.0145$$

Since sample size and margin of error are inversely proportional; as the sample size increases, margin of error decreases.