Student Information

Name : Solution

ID :

Answer 1

a)

$H_0 : \mu = 7$ and $H_A : \mu > 7$.
$z_\alpha = 1.96$ for one-sided right tail with 95% confidence.
$z = \dfrac{7.8 - 7}{1.4/\sqrt{17}} = 2.356$. Since $2.356 > 1.960$, $z > z_\alpha$, so with 95% confidence customer service is significantly successful and they deserve a raise in their salaries.

b)

The mistake would decrease the total by 9. Originally total was $7.8 * 17 = 132.6$, however with the mistake it would become 123.6. As a result μ would be 7.27. Making a similar calculation as in part a;
$z = \dfrac{7.27 - 7}{1.4/\sqrt{17}} = 0.795$. Since here $z < z_\alpha$, we can not say that customer service is successful.

c)

Note that changing the number of customers from 17 to 45 would also change the mean. New mean, $\mu' = (45 * 7.8 - 9)/45 = 7.6$. As a result;
$z = \dfrac{7.6 - 7}{1.4/\sqrt{45}} = 2.875$. Since $z > z_\alpha$, so with 95% confidence customer service can still be regarded as successful. This happened because in larger sample sizes effect of an outlier is minimal.

d)

Since μ is smaller than the threshold, z value would be negative. This is a result of the normal distribution where half of the population is expected to be in the lower part of the mean.

Answer 2

$H_0 : \mu_{new} = \mu_{old}$ and $H_A : \mu_{new} > \mu_{old}$
One-sided left tail test with $\alpha = 0.05$ and $z_\alpha = 1.645$. So;

$$z = \frac{6.2 - 5.8}{\sqrt{\frac{1.1^2 + 1.5^2}{55}}} = \frac{0.4}{0.251} = 1.593.$$ $z_\alpha > z$, so z is in acceptance region.

This would indicate that we can not reject the null hypothesis and we can not say that the new vaccine protect longer than the old vaccine.

Answer 3

For margin of error we will use the formula;

$$MOE = z * \sqrt{\frac{p * (1 - p)}{n}}$$

For 95% confidence interval $z = 1.96$.

a)

$$MOE_{Red} = 1.96 * \sqrt{\frac{0.48 * 0.52}{400}} = 0.049$$

$$MOE_{Blue} = 1.96 * \sqrt{\frac{0.37 * 0.63}{400}} = 0.047$$

Margin of error for Red candidate's estimation is $\pm 4.9\%$ and margin of error for Blue candidate's estimation is $\pm 4.7\%$.

b)

$$MOE_{Lead} = 1.96 * \sqrt{\frac{(0.48 * 0.52) + (0.37 * 0.63)}{400}} = 0.068$$

c)

Red candidate's margin of error is larger than the other. Since the survey participants who support the Red candidate and who does not support the Red candidate form two groups with nearly equal sizes, there is a high variance for Red candidate's support. This is similar to tossing a coin and guessing right. On the contrary, consider a candidate with 1% support in the survey. It is clear that there would small variance for the support of the candidate, since a big majority of the population would not be supporting him.

d)

They would decrease. If the number of survey participants is increased, they would represent the population better and they would be more homogeneous, decreasing the effect of outliers.