Student Information

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Answer 1

a)

the null hypothesis is $H_0 = 7$ and the alternate hypothesis is $H_A = \mu > 7$
Step 1: Test statistic.
$\sigma = 1.4$, $\mu = 7.8$, $n = 17$, and $\mu_0 = 7$ are given.
From the sample $\bar{X} = 7.8$
The test statistic is
$Z = \frac{\bar{X}-\mu_0}{\sigma/\sqrt{n}} = \frac{7.8-7}{1.4/\sqrt{17}} = 2.356$
Step 2: Acceptance and rejection regions. The critical value is
$z_\alpha = z_{1-0.95} = z_{0.05} = 1.645$ (since it is one sided test, we do not divide α by 2)
With the right-tail alternative:
reject H_0 if $Z > 1.645$
accept H_0 if $Z \leq 1.645$
Step 3: Result.
Our test statistic $Z = 2.356$ belongs to the rejection region; therefore, we reject the null hypothesis.The customer service can be regarded as successful.

b)

Then the mean is $\mu = \frac{7.8*17-(10-1)}{17} = 7.27$
The test statistic is
$Z = \frac{\bar{X}-\mu_0}{\sigma/\sqrt{n}} = \frac{7.27-7}{1.4/\sqrt{17}} = 0.79517$
Result.
Our test statistic $Z = 0.79517$ belongs to the accept region; therefore, we accept the null hypothesis.The customer service cannot be regarded as successful.

c)

Without mistake the test statistic is:
$Z = \frac{\bar{X}-\mu_0}{\sigma/\sqrt{n}} = \frac{7.8-7}{1.4/\sqrt{45}} = 3.83326$ (belongs to the rejection region)
With mistake:
the mean is $\mu = \frac{7.8*45-(10-1)}{45} = 7.6$
the test statistic is:
$Z = \frac{\bar{X}-\mu_0}{\sigma/\sqrt{n}} = \frac{7.6-7}{1.4/\sqrt{45}} = 2.87494$ (belongs to the rejection region)
Therefore, the mistake would not affect the customer service's success. In both cases the customer services can be regarded as successful.

d)

Then, all of our test statistics would be negative since all of our mean values are less than 8. Therefore, our test statistics would be in the accept region, we would accept the null hypothesis, so the customer services could not be regarded as successful.

Answer 2

We know both standard deviations, their set are independent, and sample size are greater than 30 we use two sample Z test.
$H_0 = \mu_1 \leq \mu_2$ $(\mu_1 - \mu_2 \leq 0)$
$H_A = \mu_1 > \mu_2$
$n_1 = n_2 = 55$, $\sigma_1 = 1.5$, $\sigma_2 = 1.1$, $x_1 = 6.2$, and $x_2 = 5.8$
$Z = \frac{(X_1 - X_2)-(\mu_1-\mu_2)}{\sqrt{\frac{{\sigma_1}^2}{n_1}+\frac{{\sigma_2}^2}{n_1}}} = \frac{(6.2-5.8)-(0)}{\sqrt{\frac{1.5^2}{55}+\frac{1.1^2}{55}}} = 1.5948$
$z_\alpha = z_{0.05/2} = z_{0.025} = 1.96$ (two-sided test; thus we divide α by 2)
reject H_0 if $Z > 1.96$
accept H_0 if $Z \leq 1.96$
Result:
Since our Z is less than 1.645, we accept the H_0, the evidence against H_0 is insufficient.Therefore, we cannot state that the new vaccine really protects for a longer duration.

Answer 3

a)

The margin of error is $Z_{\frac{\alpha}{2}} * \sqrt{\frac{p*(1-p)}{n}}$
for red party's: $p = 0.48$
$1.96 * \sqrt{\frac{0.48*(1-0.48)}{400}} = 0.04896$
for blue party's: $p = 0.37$
$1.96 * \sqrt{\frac{0.37*(1-0.37)}{400}} = 0.04731$

b)

$E = Z_{\frac{\alpha}{2}} * \sqrt{\frac{p_1*(1-p_1)}{n} + \frac{p_2*(1-p_2)}{n}}$
$1.96 * \sqrt{\frac{0.48*(1-0.48)}{400} + \frac{0.37*(1-0.37)}{400}} = 0.068$

c)

Red Party's candidate's margin of error is larger than the Blue Party's candidate's margin of error, because the difference between the percentage of the people who supports and who does not support the party is larger in Red Party (higher standard error).

d)

As the sample size increases the margin of errors would decrease, because we get closer to the actual values as the sample size increases, so errors margin decreases as we get closer to the actual values.