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Answer 1

a)

$$H_0 : \mu > 7, H_A : \mu \leq 7, n = 16, \hat{X} = 7.8, \sigma = 1.4, \alpha = 0.05, z_\alpha = 1.645 \quad (1)$$

$$\hat{X} - z_\alpha * \sigma/\sqrt{n} = 7.8 - 1.645 * 1.4/\sqrt{17} = 7.8 - 0.558 = 7.242 \quad (2)$$

Not less than 7 so it can be regarded as successful

b) $\hat{X} = ((7.8 * 17) - 9)/17 = 7.27$**. Doing the same thing as before**

$$7.27 - 1.645 * 1.4/\sqrt{17} = 7.27 - 0.558 = 6.712 \quad (3)$$

Less than 7 so it cannot be regarded as successful

c)$\hat{X} = ((7.8 * 45) - 9)/45 = 7.6$**. Doing the same calculation**

$$7.6 - 1.645 * 1.4/\sqrt{45} = 7.6 - 0.343 = 7.257 \quad (4)$$

Not less than 7 so it can be regarded as successful. Since the customers increases the mistakes' effects are smaller. Because the mean got stabilizing.

d)As we can see in the upside when mean is 7.8, we cannot reach 8 in anyway. So there is no success possibility

Answer 2

$$H_0 : \mu_1 - \mu_2 = 0, H_A : \mu_1 - \mu_2 \geq 0 \tag{5}$$

$$n = 55, \sigma_1 = 1.5, \sigma_2 = 1.1, \alpha = 0.05, z_\alpha = 1.645, \hat{X_1} = 6.2, \hat{X_2} = 5.8 \tag{6}$$

Right tailed
reject $H_0, Z \geq z_\alpha$
accept $H_0, Z < z_\alpha$

$$\hat{X_1} - \hat{X_2}/(\sqrt{(\sigma_1^2 + \sigma_2^2)/n}) = 6.2 - 5.8/\sqrt{(1.5^2 + 1.1^2)/55} = 0.4/0.25 = 1.6 \tag{7}$$

since there is a left tail and $Z = 1.6 < 1.645 = z_\alpha$ **we accept the** H_0**. This means we cannot say that new vaccine protects longer**

Answer 3

a) $p_r = 0.48, p_b = 0.37, n = 400, z_{\alpha/2} = 1.96$ **and** $\alpha = 0.05$
margin of error $= z_{\alpha/2} * \sqrt{p(1-p)/n}$
So for red

$$1.96 * \sqrt{0.48 * 0.52/400} = 4.896\% \tag{8}$$

so the margin of error is $\pm 4.896\%$
So for blue

$$1.96 * \sqrt{0.37 * 0.63/400} = 4.731\% \tag{9}$$

so the margin of error is $\pm 4.731\%$

b)Red is in the lead, so $\pm 4.896\%$

c)Red's margin of error is larger. Since the probability is closer to 0.5 **red has more margin of error. Because the closer we are to** 0.5**, the numerator will be bigger resulting in a larger margin of error**

d)Since we are including more of the population to survey. The result will be more accurate so the margin of error will decrease