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Final for Statistics 1 Fall 2020

Answer to multiple choice questions

1. A
2. A
3. D
4. C
5. B
6. C
7. A
8. B
9. A
10. E

Answer to long question 1 part (a)

$$n = 11$$

$$average = 11.1$$

$$s.d. = 0.40$$

$$less\ than\ 12.5?$$

$$t = \frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{11.1 - 12.5}{\frac{0.40}{\sqrt{11}}} = -11.608$$

$$t_{0.01} = 2.764\ with\ 10\ d.f.$$

$$rejection\ region\ is\ t < -2.764$$

$$test\ statistic\ fall\ in\ the\ rejection\ region\ so\ enough\ evidence\ that\ less\ than\ 12.5 psi$$

Answer to long question 1 part (b)

$$\bar{X} \pm z_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}}$$

$$z_{\alpha/2} = 1.812$$

$$11.1 \pm 1.812 * \frac{0.4}{\sqrt{11}}$$

$$10.88\ to\ 11.32$$

Answer to long question 2 part (a)

$$\alpha = 0.05$$

$$error = 0.01$$

$$true\ p = 0.80$$

$$n = \frac{\left(z_{\frac{\alpha}{2}}\right)^2 p(1-p)}{E^2}$$

$$\frac{(1.960)^2 * 0.8(0.2)}{0.01^2} = 6147$$

Answer to long question 2 part (b)

$$\frac{(1.960)^2 * 0.5(0.5)}{0.01^2} = 9604$$

Answer to long question 2 part (c)

$$n = 2255$$

$$p = \frac{1787}{2255} = 0.792$$

$$\alpha = 0.05$$

$$z_{\alpha/2} = 1.960$$

$$\left(\hat{p} - z_{\frac{\alpha}{2}}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}, \hat{p} + z_{\frac{\alpha}{2}}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right)$$

$$\left(0.792 - (1.960)\sqrt{\frac{0.792(1-0.792)}{2255}}, 0.792 + (1.960)\sqrt{\frac{0.792(1-0.792)}{2255}}\right)$$

$$0.775\ to\ 0.8087$$

Answer to long question 3 part (a)

$$null: average\ cost = 6500$$

$$alternate: average\ cost > 6500$$

Answer to long question 3 part (b)

$$\alpha = 0.05$$

$$z > 1.645$$

Answer to long question 3 part (c)

$$\frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{6819 - 6500}{\frac{1265}{\sqrt{36}}} = 1.51$$

Answer to long question 3 part (d)

$1.51\ \ does\ not\ fall\ in\ the\ rejection\ region\ so\ not\ enough\ evidence\ that\ cost\ is\ more\ than\ 6500$

Answer to long question 3 part (e)

$$P(X > 6500) = P(Z > 1.51) = 1 - 0.9345 = 0.0655$$

Answer to long question 4 part (a)

NF=3095
XF=83.6
SF=194.7

NN=5782
XN=59.1
SN=152.1

$$(\overline{X_1} - \overline{X_2}) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$\alpha = 0.05$$

$$z_{\frac{\alpha}{2}} = 1.960$$

$$interval\ for\ \mu_F - \mu_N$$

$$(83.6 - 59.1) \pm 1.960 \sqrt{\frac{194.7^2}{3094} + \frac{152.1^2}{5782}}$$

$$16.59\ to\ 32.4$$

Answer to long question 4 part (b)

$$H_0 = D_0 = 0$$

$$z = \frac{(\overline{X_1} - \overline{X_2}) - D_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$z = \frac{(83.6 - 59.1) - 0}{\sqrt{\frac{194.7^2}{3094} + \frac{152.1^2}{5782}}} = 6.077$$

$$rejection\ region\ (\alpha = 0.01){:}\ z > 2.326\ or\ z < -2.326$$

$$since\ 6 > 2\ we\ reject\ the\ null\ hypothesis$$

$$there\ is\ enough\ evidence\ that\ there\ is\ a\ difference\ between\ the\ population\ means$$

Answer to long question 5 part (a)

	x	y	x^2	y^2	xy
	0	1	0	1	0
	1	5	1	25	5
	2	3	4	9	6
	3	9	9	81	27
	4	7	16	49	28
sum	10	25	30	165	66

Answer to long question 5 part (b)

$$b_1 = \frac{\sum x_i y_i - (\sum x_i)(\sum y_i)/n}{\sum x_i^2 - (\sum x_i)^2/n} = \frac{66 - (10)(25)/5}{30 - (10)^2/5} = 1.6$$

$$b_0 = \frac{1}{n}(\sum y_i - b_1 \sum x_i) = \frac{1}{5}(25 - 1.6 * 10) = 1.8$$

Answer to long question 5 part (c)

$$r = \frac{\sum x_i y_i - (\sum x_i)(\sum y_i)/n}{\sqrt{\left[\sum x_i^2 - \frac{(\sum x_i)^2}{n}\right][\sum y_i^2 - \frac{(\sum y_i)^2}{n}]}} = \frac{66 - (10)(25)/5}{\sqrt{\left[30 - \frac{10^2}{5}\right]\left[165 - \frac{25^2}{5}\right]}} = 0.8$$