KFUPM
Mathematical Sciences

Term 043
STAT 212
Quiz# 2

Date: 17/7/2005
Duration: 15 minutes

Name: ID#: Section#: 1 2 Serial#:

Show your work in detail

There are a number of highly touted search engines for finding things of interest on the Internet. Recently, a consumer rating system ranked two search engines ahead of the others. Now, a computer user's magazine wishes to make the final determination regarding which one is actually better at finding particular information. To do this, each search engine was used in an attempt to locate specific information using specified key words. Both search engines were subjected to 100 queries. Search engine 1 successfully located the information 88 times and search engine 2 located the information 80 times. Using a significance level equal to 0.05, what is the p-value based on the sample results?

a. 0.3456
b. 0.0618
c. 0.1236
d. None of the above.

$H_0: p_1 = p_2$

$H_A: p_1 \neq p_2$

$\alpha = 0.05$

$n_1 = n_2 = 100, \quad x_1 = 88, \quad x_2 = 80 \Rightarrow \bar{p}_1 = 0.88, \quad \bar{p}_2 = 0.8$

$$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{88+80}{200} = \frac{168}{200} = \boxed{0.84}$$

$$Z_0 = \frac{(\bar{p}_1 - \bar{p}_2) - 0}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \frac{0.88 - 0.80}{\sqrt{(0.84)(0.16)\frac{2}{100}}} = \frac{0.08}{\sqrt{0.002688}}$$

$$= \frac{0.08}{0.052} = \boxed{1.54} \Rightarrow$$

$$p\text{-value} = P(|Z| > |Z_0|) = 2P(Z > |Z_0|) = 2P(Z > 1.54)$$
$$= 2(0.5 - P(0 < Z < 1.54)) = 2(0.5 - 0.4382)$$
$$= 2(0.0618) = \boxed{0.1236}$$

Assumptions: (1) Large samples (2) Independent samples.
(3) $n_1\bar{p}_1 = 88 \geq 5, \quad n_1(1-\bar{p}_1) = 12 \geq 5, \quad n_2\bar{p}_2 = 80 \geq 5, \quad n_2(1-\bar{p}_2) = 20$

With My Best Wishes

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A company in Maryland has developed a device that can be attached to car engines, which they believe will increase the miles per gallon that cars will get. The owners are interested in estimating the difference between mean mpg for cars using the device versus those that are not using the device. The following data represent the mpg for random samples of cars from each population.

$n_1 = 6$ $\bar{x}_1 = 25.45$ $s_1 = 3.954$

X_1 With Device	X_2 Without Device
22.6	26.9
23.4	24.4
28.4	20.8
29.0	20.8
29.3	20.2
20.0	26.0
	28.1
	25.6

$n_2 = 8$ $\bar{x}_2 = 24.1$ $s_2 = 3.087$

Given this data, which of the following statements is true?

a. Given the sample information, using 95 percent confidence, we can't conclude that a difference exists in the population mean mpg between vehicles that use the new device versus vehicles that do not use the new device.

b. The sample information produces a 95 percent confidence interval that leads us to believe that a difference does exist between the population mean mpg between vehicles that use the new device versus vehicles that do not use the new device.

c. The sample sizes used are too small to produce a confidence interval estimate that could have any value in reaching a decision about the two engine devices.

d. None of the above.

$H_0: \mu_1 - \mu_2 = 0$ vs. $H_A: \mu_1 - \mu_2 \neq 0$

$S_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}} = \sqrt{\frac{5(3.954)^2 + 7(3.087)^2}{6+8-2}}$

$= \sqrt{\frac{144.876}{12}} = \sqrt{12.073} = \boxed{3.475}$

$t_0 = \frac{(\bar{x}_1 - \bar{x}_2) - D_0}{S_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} = \frac{25.45 - 24.1}{(3.475)\sqrt{\frac{1}{6}+\frac{1}{8}}} = \boxed{0.72}$

Assumptions:
1. Indep. samples
2. Small samples
3. Assume Normality
4. Unknown σ's.
5. Equal σ's.

So, use t and Calculate S_p.

With My Best Wishes

$t_{\frac{\alpha}{2}, n_1+n_2-2} = t_{0.025, 12} = \boxed{2.1788}$

DR: If $|t_o| > |t_{\frac{\alpha}{2}}| \Rightarrow$ Reject H_o

Decision: Since $|t_o| = 0.72 \not> 2.179 = t_{\frac{\alpha}{2}} \Rightarrow$

Do NOT reject H_o.

Conclusion: There is NO evidence ~~that~~ a difference exists between the means of the two populations.