Department of Mathematics and Statistics KFUPM
STAT 319-02 Quiz#5, Time: 40 mins

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The diameter of steel rods (measured in inches) manufactured on two different extrusion machines is being investigated. Two random samples of sizes $n_1$and n_2 are selected. The sample information for the two machines in the form of sample sizes, means and variances is given as:

Machine 1: n_1 =32, $\bar{x}_1 = 8.73$, $s_1^2 = 0.35$

Machine 2: $n_2 = 10$, $\bar{x}_2 = 8.68$, $s_2^2 = 0.40$.

Use this sample information to answer the following questions.

a. Test the hypothesis that the mean diameter of steel rods produced by machine 1 is 8 inches. Use table value (critical value) approach at type I error rate of 0.03.

b. Construct a 99% confidence interval for the difference in mean rod diameters produced by two machines. Use this interval to test the hypothesis of no difference in mean rod diameters.

c. Is there evidence to support the claim that the mean diameters of two machines differ by at most 0.10 inches? Use p value approach to make your decision at 2% level of significance.

d. The two extrusion machines are supposed to produce an equal proportion of defectives. Two random samples of sizes $n_1$and n_2 are selected. The sample information for the two machines in the form of sample sizes and number of defectives is given as:

Machine 1: n_1 =80, $X_1 = 3$

Machine 2: $n_2 = 100$, $X_2 = 2$

Using this sample information:

i. test the hypothesis of equal proportion of defectives produced by two extrusion machines, with 0.04 as type I error rate.

ii. Construct a 96% confidence interval for the difference in the proportions of defectives produced by two extrusion machines. Interpret this interval and use it to verify the decision of part (i) above.

Confidence Interval	Test Statistic
$\bar{x} \pm Z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$ and $n \geq \left(\frac{\sigma Z_{\frac{\alpha}{2}}}{e} \right)^2$	$Z = \frac{\bar{x}-\mu_0}{\sigma/\sqrt{n}}$
$\bar{x} \pm t_{\frac{\alpha}{2},n-1} \frac{s}{\sqrt{n}}$	$T = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$
$(\bar{x}_1 - \bar{x}_2) \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$	$Z = \frac{(\bar{x}_1-\bar{x}_2)-d_0}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$
$(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2},n_1+n_1-2} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$	$T = \frac{(\bar{x}_1-\bar{x}_2)-d_0}{s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$ where $s_p = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$
$(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2},v} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$	$T = \frac{(\bar{x}_1-\bar{x}_2)-d_0}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$ where $v = \frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{(s_1^2/n_1)^2}{n_1-1}+\frac{(s_2^2/n_2)^2}{n_2-1}}$
$\bar{d} \pm t_{\frac{\alpha}{2},n-1} \frac{s_d}{\sqrt{n}}$	$T = \frac{\bar{d}-d_0}{s_d/\sqrt{n}}$
$\hat{p} \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ and $n \geq \frac{Z_{\frac{\alpha}{2}}^2[\hat{p}(1-\hat{p})]}{e^2}$	$Z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$
$(\hat{p}_1 - \hat{p}_2) \pm Z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$	$Z = \frac{\hat{p}_1-\hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left[\frac{1}{n_1}+\frac{1}{n_2}\right]}}$ where $\hat{p} = \frac{x_1+x_2}{n_1+n_2} = \frac{n_1\hat{p}_1+n_2\hat{p}_2}{n_1+n_2}$