STAT 381-13605 **Take-home Quiz** **Fall 2006**

Solution

1. Psychologists wish to investigate the learning ability of schizophrenic people after they have taken a specified dose of a tranquilizer. Thirteen patients were given the drug and one hour later they were given a standardized exam. Their scores are listed here:

   15 20 30 27 24 22 22 17 21 25 23 27 25

   Generally patients score around 20 on the exam. Is there statistical evidence that taking the tranquilizer has made significant changes in their scores given significance level 0.05?

1) State the hypotheses: H_0: $\underline{\mu = 20}$ vs. H_1: $\underline{\mu \neq 20}$

2) **Sample size** n = ___13________ **Sample mean** $\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i =$ __22.92____

Sample standard deviation S = $\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2}$ = _4.13_____

3) Compute the test statistic

$$t_o = \frac{\bar{X} - \mu}{\left(\frac{S}{\sqrt{n}}\right)} = \frac{22.92 - 20}{\left(\frac{4.13}{\sqrt{13}}\right)} = 2.55 \quad > 0$$

4) Calculate the p-value degrees of freedom = $n-1$ =12

The test is a two-sided test since H_1: $\mu \neq 20$.

$0.01 < P(t > t_0) < .025$ since 2.179 < 2.55 <2.681

$p - value = 2 \cdot P(t > t_o)$, then p-value < .05

5) Conclusion and interpret the results.

There is significant evidence to indicate that the mean score is different from 20 after the tranquilizer has been taken.

2. In 1999, 17% of high school students smoked frequently (20 or more days a month). An education campaign aimed at reducing teen smoking was instituted. To determine whether it was effective, a new study interviewed 500 high-school students. Of these, 80 smoked frequently. Our job is to decide whether this is attributable to a real drop in smoking or can be attributed to the fact that we've only looked at a sample.

1). Hypotheses: H_0 : ____p=0.17__________ vs. H_1 : ____p<0.17__________

2). Sample size n = ____500_____, **sample proportion** $\hat{p}$ = ___0.16_____ .

3). Level of significance α = 0.10. Rejection region is ___{ z < -1.282 }_____

4). Observed value of the test statistic:

$$z_o = \frac{\hat{p} - p_o}{\sqrt{p_o(1-p_o)/n}} = \frac{0.16 - 0.17}{\sqrt{0.17 \cdot (1-0.17)/500}} = -0.595$$

5). Calculate the p-value

p-value = $P(Z < z_0) = P(Z < -0.595) = \Phi(-0.595) = 0.2743$

6). Conclusion and interpret the results.

Since p-value 0.2743 is greater than the significance level α =0.10, there is no enough evidence to reject H_0.