## §8.3 Observed Significance Levels: p-values

As was seen in the previous section, the choice of $\alpha$ can make a difference in the test either rejecting or failing to reject $H_0$. In practice it is often better to report the observed significance level for the test and leave the conclusion to the reader.

Def The observed significance level, or p-value, for a specific statistical test is the probability (assuming $H_0$ is true) of observing a value of the test statistic that is at least as contradictory to the null hypothesis, and supportive of the alternative hypothesis, as the actual one computed from the sample data.

Example In the previous section notes, the example on sleeping students had $H_0: \mu = 2.75$, $H_a: \mu \neq 2.75$, $\sigma = .6$. the sample had $\bar{x} = 2.85$. Find the p-value.

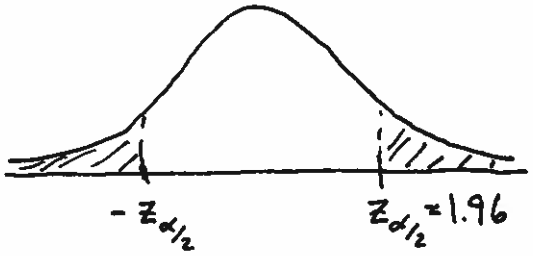
Here we will use the stat → Tests → z-test. Enter in our statistics and calculate to get:

$\mu \neq 2.75$
$z = 2.0412$ which is what we calculated
$p = 0.0412$ ← the value ask for in the problem

$\bar{x} = 2.85$, $n = 150$ } reminding you of what we used.

For what we did in section 8.2, $z > z_{\alpha/2}$ or $p < \alpha = .05$, so we reject the null hypothesis and say the date supports $H_a$ at an observed significance leve of $p = 0.0412$.

In the example




$z = 2.0412 > z_{\alpha/2}$

$p = .0412 < \alpha = .05$

▨ - rejection region > p

If the test statistic satisfied $z < -z_{\alpha/2}$ we would still reject $H_0$. In either case $p < \alpha \Rightarrow$ reject $H_0$, $p > \alpha \Rightarrow$ fail to reject $H_0$.

Example In section 8.2 we had the "greener lawn" example where $\mu = 5$, $\sigma = 1.5$. $H_0: \mu = 5$, $H_a: \mu > 5$, and the sample statistic was $\bar{x} = 5.31$. Find the p-value. ($n = 100$).

If we enter the data into stat → Tests → z-test... we get:

$\mu > 5$
$z = 2.0667$ which we calculated
$p = 0.01938$ ← the value ask for in this problem.

$\bar{x} = 5.31$ } reminder of what we entered.
$n = 100$

Since the $\alpha = .01$ we used is smaller than p, we failed to reject $H_0$ in section 8.2. However we can say that the data supports rejecting $H_0$ at an observed significance of $p = 0.01938$.