## *p*-values

A *p*-value is used as an alternative method to make a decision on the null hypothesis. A *p*-value is a probability. It is a measure of the strength of evidence to reject, or fail to reject, the null hypothesis. The smaller the *p*-value, the less likely the null hypothesis is true and vice versa.



The decision to reject, or fail to reject,  $H_0$  is based on the comparison of the *p*-value with the level of significance. On our course we only use a two-tailed test at the 5% level of significance.

Critical *p*-value = 0.05 at the 5% significance level. If  $p \le 0.05$ , there is strong evidence to reject H<sub>0</sub>. If p > 0.05, there is strong evidence to fail to reject H<sub>0</sub>.

## Memory aid: If p is low, $H_0$ must go.

The lower the *p*-value, the stronger the evidence against  $H_0$ . The larger the sample size, the more precise the estimates.

## p-value approach to perform a hypothesis test

- 1. State  $H_0$  and  $H_A$ .
- 2. Calculate the z score (this is often called the test statistic, T).
- 3. Determine the *p*-value (a diagram is useful).
- 4. If  $p \le 0.05$ , reject H<sub>0</sub>. If p > 0.05, do not reject H<sub>0</sub>.
- 5. State the conclusion in words.

## Type I and type II errors

Type I error: Rejecting H<sub>0</sub> when it is true.

Type II error: Failing to reject H<sub>0</sub> when it is false.

Note: The strength of evidence using a *p*-value is enhanced by also including a 95% confidence interval for the population mean,  $\mu$ .