

## Hypothesis Test for The Mean of A Single Population: Unknown Variance

A computer scientist is investigating the usefulness of a new design language in improving programming tasks. Historically, the mean time for programming this a particular standard function in the presently-used language is 21.3 minutes and the scientist is convinced the new language can only lower the times. Twelve expert programmers are asked to code the same standard function in the language, and the times (in minutes) are recorded. The data are:

17 16 21 14 18 24 16 14 21 23 13 18

If  $\mu$  is the population mean programming time of the standard function using the new language, the hypotheses to be tested are  $H_0 : \mu = 21.3$  and  $H_a : \mu < 21.3$ .

The observed value of the standardized test statistic is

$$t^* = \frac{\bar{y} - \mu_0}{s/\sqrt{n}} = \frac{17.9167 - 21.3}{3.6296/\sqrt{12}} = -3.23$$

The p-value of the test is the area under a  $t_{11}$  density curve below  $-3.23$  which equals 0.0080.

The test will reject  $H_0$  in favor of  $H_a$  at any significance level greater than 0.0080: in particular, at the usual 0.05 level and the 0.01 level.