

# EXST 7005

Fall 2010

## Lab #4: One-Sample T-test

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### One-sample T-test

A one-sample t-test can be used to test whether the mean of a normally distributed population has a value specified in a null hypothesis. SAS will compute the sample mean and compare it with the value specified in the null hypothesis. The underlying assumption of the t-test is that the observations are randomly drawn from a normally distributed population.

For example, we are testing whether the mean length of a certain type of court case is 80 days using 20 randomly chosen cases. The data are read into SAS by the following DATA step:

```
data COURT;
input TIME @@;
datalines;
43 90 84 87 116 95 86 99 93 92
121 71 66 98 79 102 60 112 105 98
;
run;
```

The only variable in the data set, TIME, is assumed to be normally distributed. The double trailing at signs (@@) after the variable's name is used to tell SAS to read multiple observations from each line.

The following code invokes PROC TTEST for a one-sample t test with the null hypothesis that the mean equals to 80:

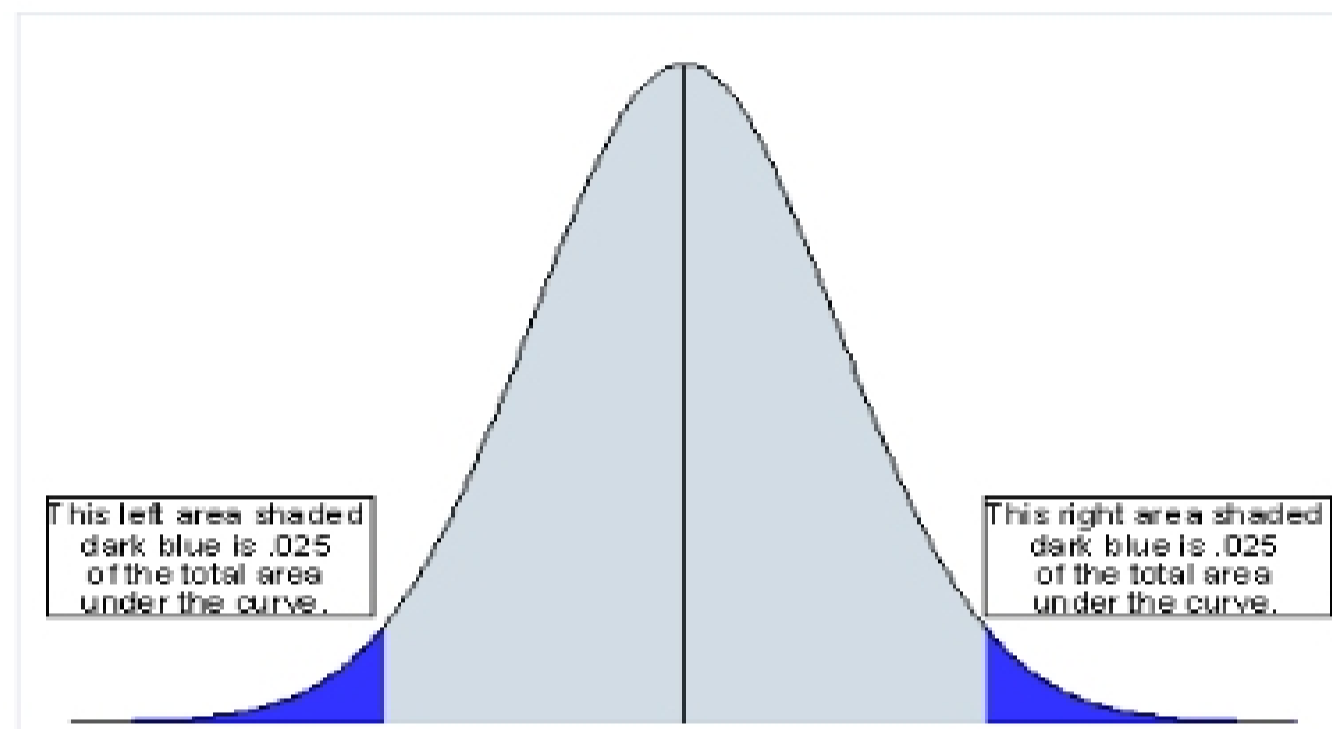
```
proc ttest h0=80;
var time;
run;
```

The VAR statement indicates that the time variable is being studied, while the H0= option specifies the null hypothesis. If you don't put this option, the default null hypothesis will be that the mean equals to 0. Usually, the SAS gives two-tailed values for t-test.

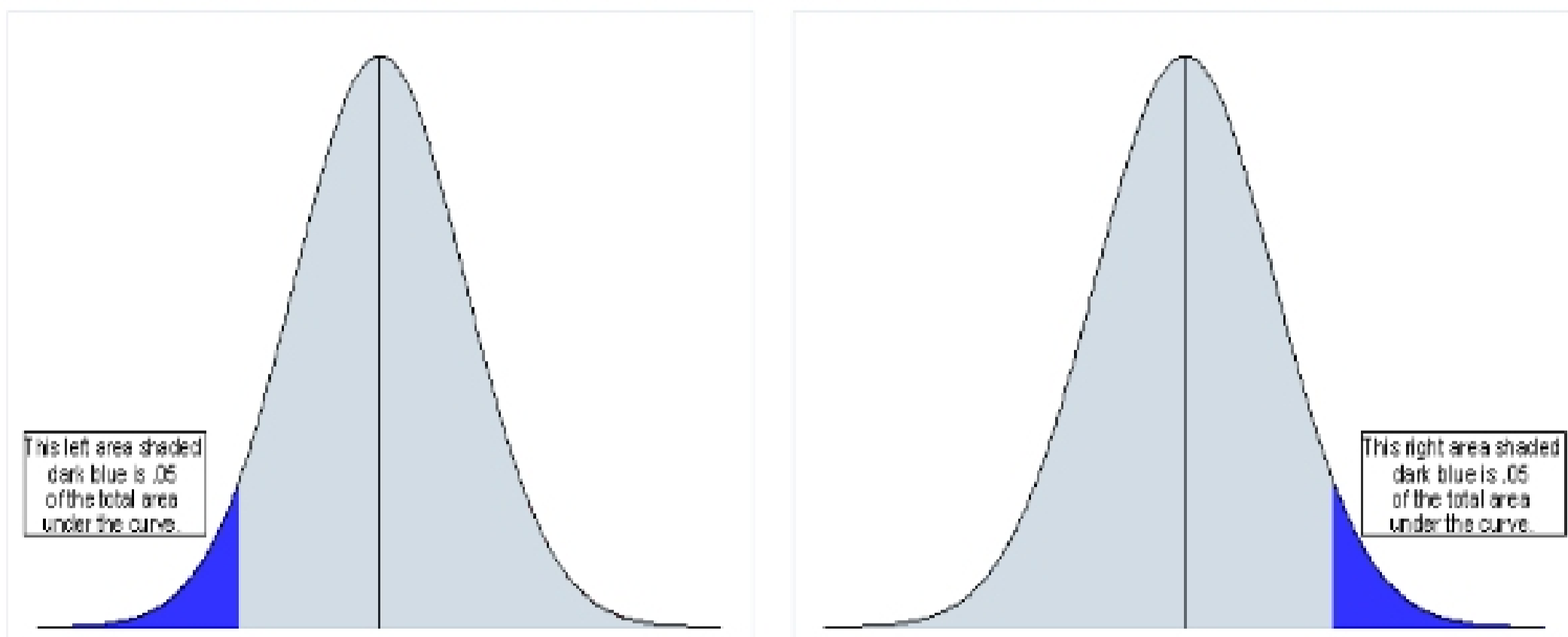
T-Tests			
Variable	DF	t Value	Pr >  t
Time	19	2.30	0.0329

## One Tail vs Two Tail

If you are using a significance level of 0.05, a two-tailed test allots half of your alpha to testing the statistical significance in one direction and half of your alpha to testing statistical significance in the other direction. For example, we may wish to compare the mean of a sample to a given value  $x$  using a t-test. A two-tailed test will test both if the mean is significantly greater than  $x$  and if the mean significantly less than  $x$ . The mean is considered significantly different from  $x$  if the test statistic is in the top 2.5% or bottom 2.5% of its probability distribution, resulting in a p-value less than 0.05.



When using a one-tailed test, you are testing for the possibility of the relationship in one direction and completely disregarding the possibility of a relationship in the other direction. Let's return to our example comparing the mean of a sample to a given value  $x$  using a t-test. A one-tailed test will test either if the mean is significantly greater than  $x$  or if the mean is significantly less than  $x$ , but not both. The one-tailed test provides more power to detect an effect in one direction by not testing the effect in the other direction.



Since the one-tailed test provides more power to detect an effect, you may be tempting to use a one-tailed test when you have a hypothesis about the direction of an effect. However, it is inappropriate to conduct a one-tailed test to get significance testing result after a two-tailed test failed to reject the null hypothesis.

You can easily convert a two-tail p-value into a one-tail p-value by dividing by 2.

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### Assignment

1. Given below are data on dental measurements of a group of girls:

23.0 25.5 26.0 26.5 23.5 22.5 25.0 24.0 21.5 19.5  
28.0 25.0 21.5 29.0 24.5 26.0 27.5 25.5 23.0 22.5

Conduct the appropriate analysis using **proc ttest** to determine whether or not dental measurement differs from the hypothesized value of 24. Report the value of the t-test statistic and the p-value for a two-tailed test. ( $\alpha=0.05$ ).

2. Average systolic blood pressure of a normal male is supposed to be about 129. Measurements of systolic blood pressure on a sample of 12 adult males from a community whose dietary habits are suspected of causing **high** blood pressure are listed below:

115 134 131 143 130 154 119 137 155 130 110 138

Using **proc ttest**, determine if the data justify the suspicions regarding the blood pressure of this community ( $H_1 > 129$ ) at the significance level of 0.05. Explain.