

EXST 7005

Fall 2010

Lab #5: Alternative Methods to Test Hypotheses

Besides PROC TTEST, there are other methods available for testing hypotheses about a single sample mean, for example, we can calculate t-value by hand and then find the corresponding p-value in a t-table. In SAS, we can test hypotheses about a single sample mean by using PROC UNIVARIATE and PROC MEANS.

Example

The data shown in the table below relates to the effectiveness of a new brand of insecticide.

Location	1	2	3	4	5	6	7	8	9	10
# Dead	88	93	85	77	80	91	89	82	95	84

1000 insects of a particular species were put into a chamber and exposed to an insecticide for 15 seconds at 10 different locations. The response is the number of dead insects. If the average number of dead insects from these locations is larger than 82, the insecticide can be considered effective. Does the data show effectiveness of the insecticide? Test using significance level of $\alpha=0.05$.

Proc Univariate

PROC UNIVARIATE could produce t-test results: under the heading "Tests for Location: $\mu_0=0$ " in the output appears a Student's t statistic along with its associated p-value. However, remember that this is a two-tailed test of the null hypothesis that the sample mean is 0. If you want to test the hypothesis that the mean is a number other than 0, you must create a new variable by subtracting your hypothesized value from the original data, and then run the UNIVARIATE procedure on your new variable.

```
data insecticide;
input killno @@;
diff=killno-82;
datalines;
88 93 85 77 80 91 89 82 95 84
;
proc univariate data=insecticide;
var diff;
run;
```

After running this program, we will get a t-value which is 2.39 and a p-value which is 0.04. It is smaller than 0.05, so we reject the null hypothesis which means the insecticide should be considered significantly effective.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	2.392498	Pr > t	0.0404
Sign	M	2.5	Pr >= M	0.1797
Signed Rank	S	17	Pr >= S	0.0430

Proc Means

In PROC MEANS, there are the following options:

t provides the value of the t test statistic.

prt provides the p-value associated with the test statistic.

clm provides two-sided 95% confidence limits on the mean. If your hypothesized value falls within the limits, you would fail to reject the null hypothesis.

uclm provides an upper one-sided 95% confidence limit on the mean. If your hypothesized value is greater than the upper confidence limit, you would reject the null hypothesis that the mean is less than your value.

lclm provides a lower one-sided 95% confidence limit on the mean. If your hypothesized value is less than the lower limit, you would reject the null hypothesis that the mean is greater than your value.

We have two ways of using PROC MEANS to get the results. The first method is using the options in PROC MEANS to directly produce t-test results. The t-test value and p-value are the same as those we got from PROC UNIVARIATE:

```
proc means data=insecticide t prt;
var diff;
run;
```

Analysis Variable : diff	
t Value	Pr > t
2.39	0.0404

The second method is using options with PROC MEANS to estimate confidence intervals. Then we can use confidence intervals to judge whether to accept the null hypothesis or not.

```
proc means data=insecticide clm;
var killno;
run;
```

Analysis Variable : killno	
Lower 95% CL for Mean	Upper 95% CL for Mean
82.2397077	90.5602923

Since the 95% lower confidence limit is larger than the hypothesized value, we can reject the null hypothesis. This is consistent with the results we obtained from the t-test.

Assignment

The numbers of raisins in each of 14 miniboxes (1/2-ounce size) were counted for a generic brand as follows: 31 25 26 28 34 29 28 30 28 32 30 27. Determine whether there is sufficient evidence to indicate the mean numbers of raisins per minibox is 26.5. Test using $\alpha = 0.01$.

You are supposed to use the following five methods to do it. The results you get should be consistent. (2 points for each; log is also requested or 1 point off.)

- 1) By hand. List the formulas you use.
- 2) PROC TTEST.
- 3) PROC UNIVARIATE.
- 4) PROC MEANS, using t-test options.
- 5) PROC MEANS, using confidence limits options.