One Sample *t*-Test

Purpose: One sample *t*-test is a statistical procedure often performed for testing the mean value of a distribution. It can be used under the assumption that sampled distribution is normal. For large samples, the procedure often performs well even for non-normal populations.

Example: To test whether the average weight of student population is different from 140 lb.

Data: A random sample of 22 students' weights from student population. Data file **studentp.sav** can be downloaded from Dr. Chang's web page. Or, use the following data.

135	119	106	135	180	108	128	160	143	175	170
205	195	185	182	150	175	190	180	195	220	235

To perform One Sample *t*-Test for the data above:

1. **Create data file**: Enter the data in SPSS, with the variable "weight" takes up one column as shown in the picture on the right.

2. **Check Normality**: Since the test is for studying samples from normally distributed populations, the first thing to do, after the data is ready, is to check for normality. That is, click through the following menu selections **Analyze / Descriptive Statistics / Explore …** as shown in the following picture. The Explore dialog box will appear on the screen.
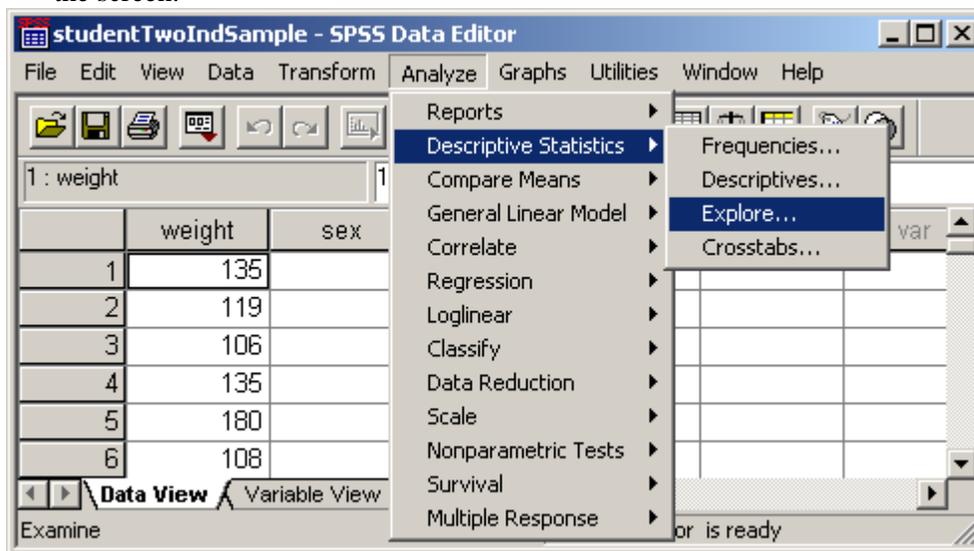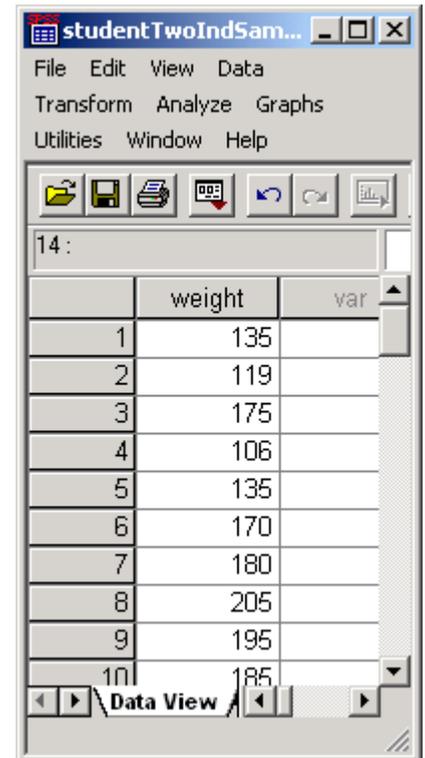
In the **Explore** dialog box, select "weight" into the Dependent as in the following picture. For normality test, click the **Plots** button. The **Explore: Plots** dialog box will appear on the screen. Check the **Normality plot and tests** box and click **Continue** in the **Explore: Plots** dialog box and then click **OK** in the Explore dialog box.
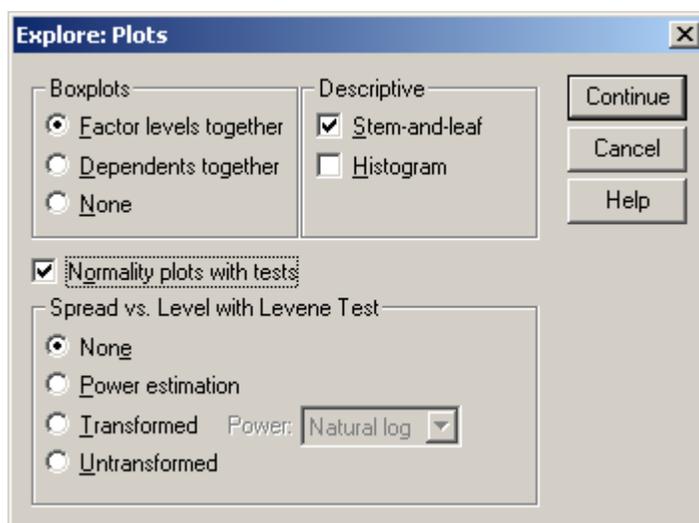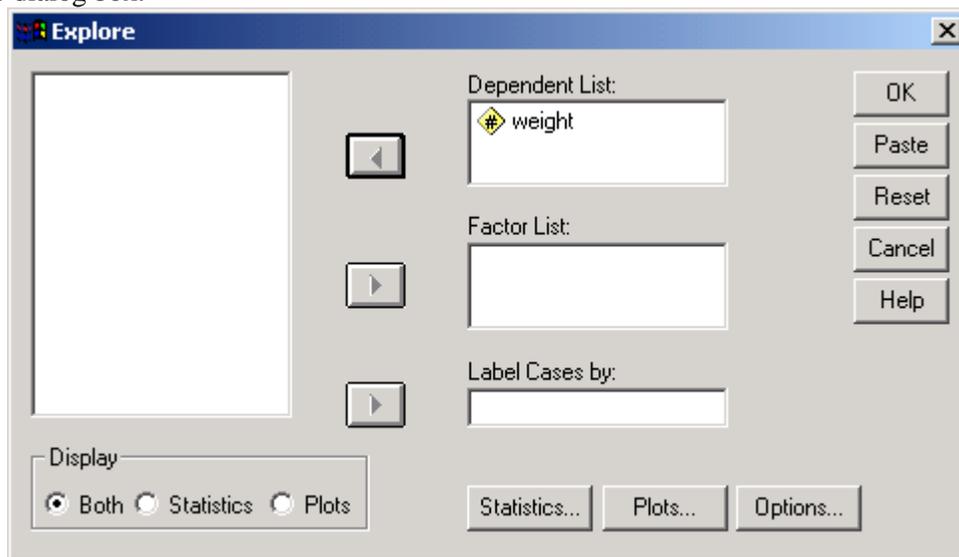
The normality test result as shown in the following table will appear in the SPSS Output window. The p-values .200 and .674 from Shapiro-Wilk test of normality are both greater than 0.05 which imply that it is acceptable to assume that the weight distribution is normal (or bell-shaped).

Tests of Normality

|	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
WEIGHT	.137	22	.200*	.969	22	.674

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

2

3. **To perform the one sample _t_-test**, first click through the menu selections **Analyze / Compare Means / One Sample T Test…** as in the following picture, and the One-Sample T Test dialog box will appear on the screen.
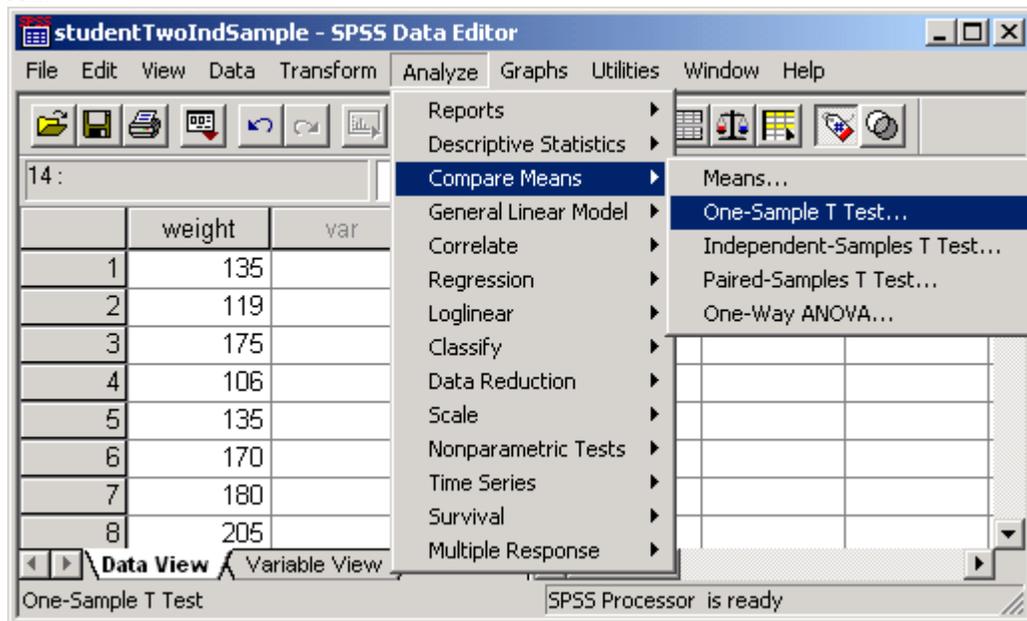
Select the variable "weight" to be analyzed into the Test Variable box, and enter the Test Value which the average value to be tested with (the mean value specified in the null hypothesis, that is **140** in this example). Click **Continue** and click **OK** for performing the test and estimation. The results will be displayed in the SPSS Output window.
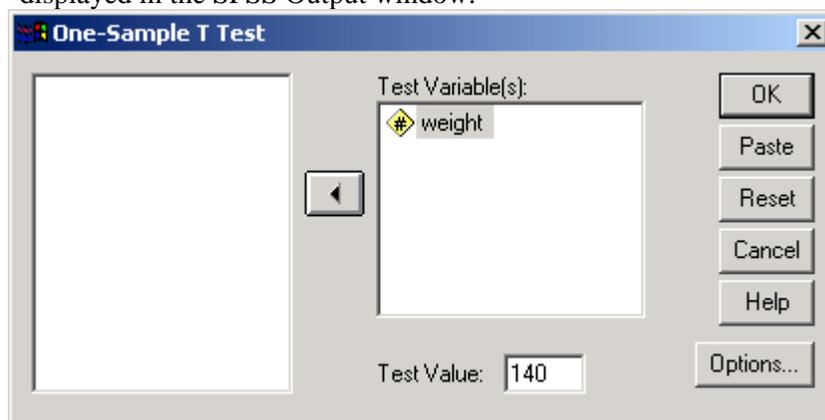
Interpret SPSS Output: The statistics for the test are in the following table. The one sample _t_-test statistic is 3.582 and the _p_-value from this statistic is **.002** and that is less than 0.05 (the level of significance usually used for the test) Such a _p_-value indicates that the average weight of the sampled population is statistically significantly different from 140 lb. The 95% confidence interval estimate for the difference between the population mean weight and 140 lb is (**11.27, 42.46**).
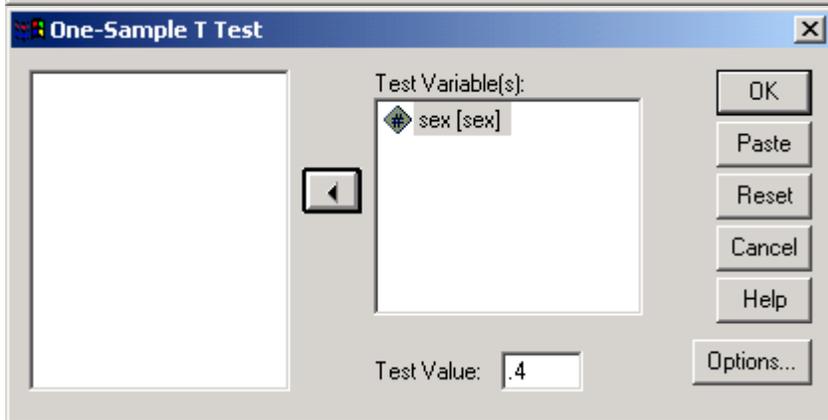
One-Sample Test

| | Test Value = 140 | | | | | |
| | | | | | 95% Confidence Interval of the Difference | |
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
WEIGHT	3.582	21	.002	26.86	11.27	42.46

3

Remark: The procedure can be used for approximating a test for a population proportion when one expects to observe at 10 observations for each category in the sample (a condition for Central Limit Theorem). If the data is from a population consisting of two categories of data values, consider one of the values is 1 and the other is 0 in the data file, then the sample mean of this data is the same as the sample proportion of 1's in the data. To use this test for testing proportion, you should code the category for which its percentage is to be tested as 1 and the other category as 0. Then, perform the one sample *t*-test with a test value set to the percentage that you wish to test. If it is 40%, then you should enter .4 as the test value. The t-test procedure will provide the statistics for testing the desired hypothesis for testing a population proportion.

Example: From studentp.sav file the male is coded as 1 and female is coded as 0, and the data for sex variable is as the following. If one wishes to test whether the percentage of male population is 40% or not, first, one should enter the data into the date editor as in the following picture, and following the same steps as described in this note.

       Data: 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1
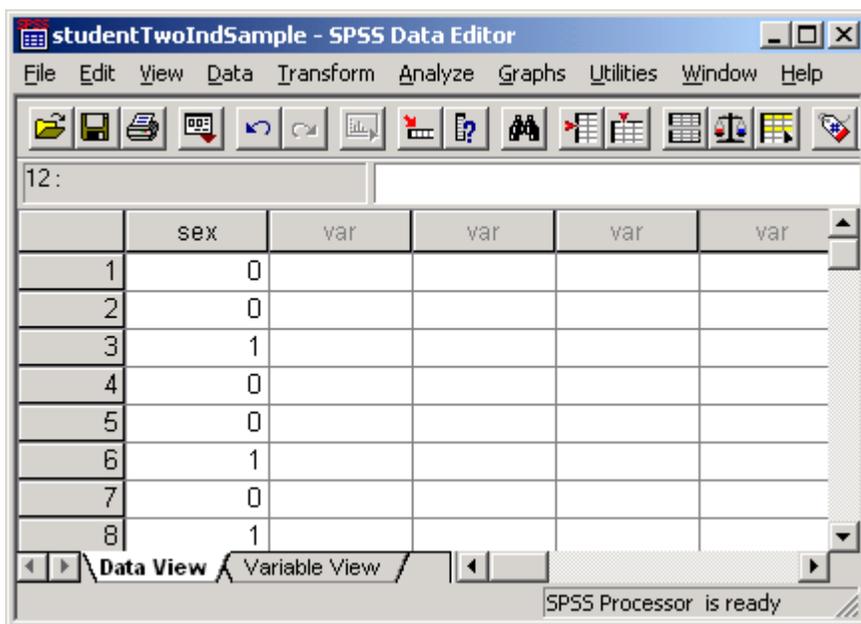
Interpretation of SPSS output: The *p*-value of the test is **.090**, which is greater than the level of significance 0.05. It indicates that the percentage of male students is not significantly different from 40%. The positive *t* score implies that the sample proportion is greater than 40% but the evidence (based on the p-value) is insufficient to conclude that the percentage of male students in the population is significantly different from 40%.

One-Sample Test

					Test Value = .4		
						95% Confidence Interval of the Difference	
				Mean		Difference	
	t	df	Sig. (2-tailed)	Difference	Lower	Upper
sex	1.779	21	.090	.19	-3.22E-02	.41

4