

Two Independent Samples *t*-Test

Purpose: Two independent sample *t*-test is for comparing means of two independent normally distributed populations. For large samples, the procedure often performs well even for non-normal populations. The procedure will also produce confidence interval estimate for the difference of two means.

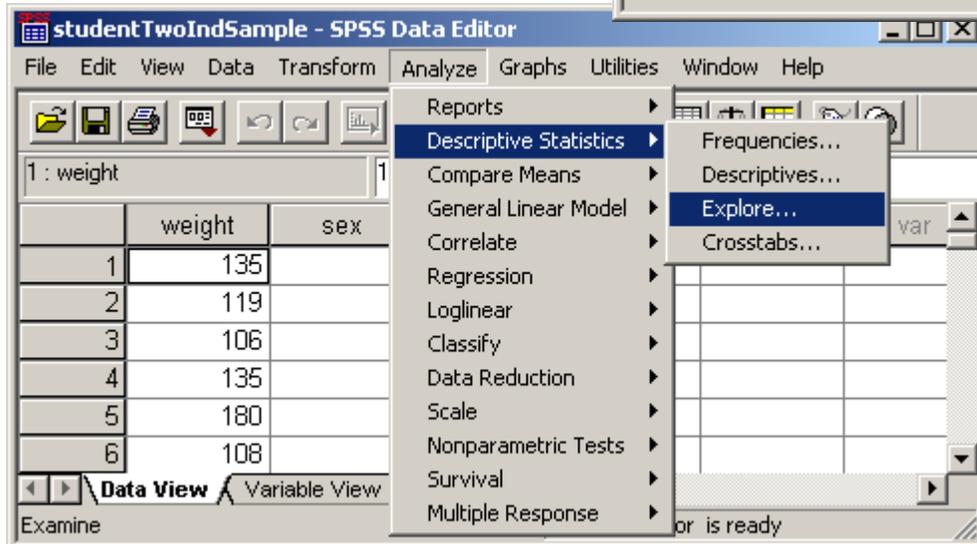
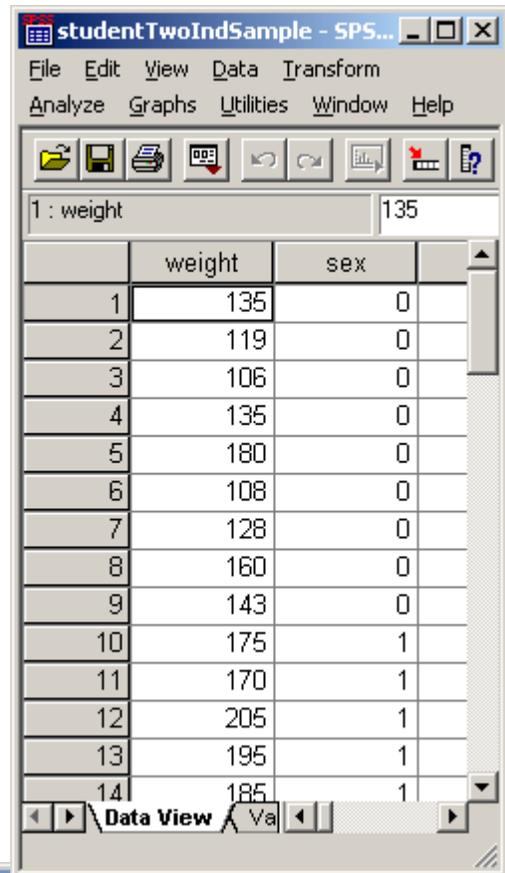
Example: Comparing average weights between male and female subjects using two independent samples.

Data: Two independent random samples of weights, one from male population and one from female population. Same data can be found at <http://www.cc.yzu.edu/~ghchang/stat/studentp.sav> .

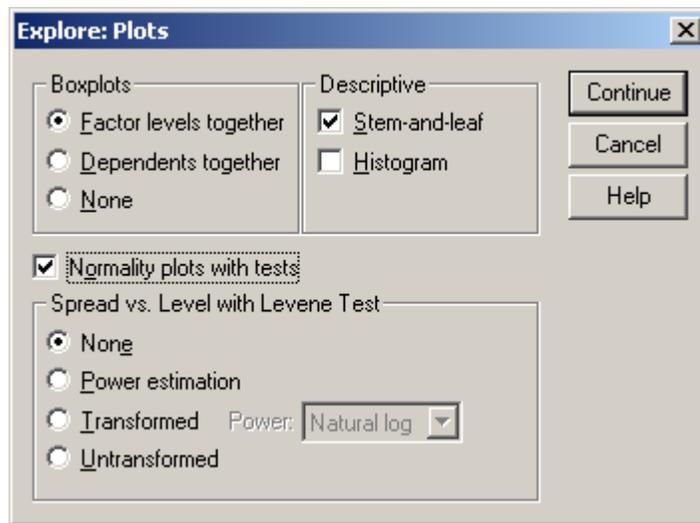
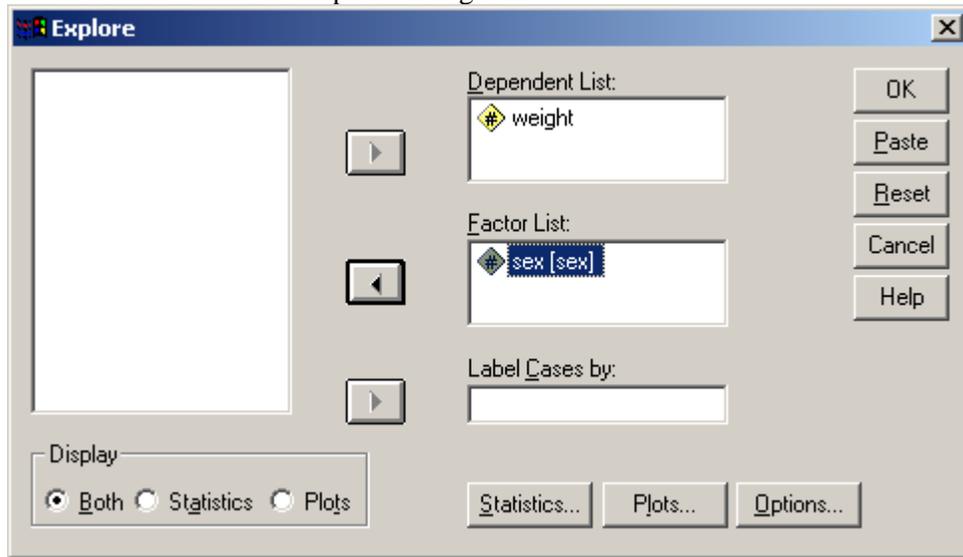
Female ($n_1=9$)	135	119	106	135	180	108	128	160	143				
Male ($n_2=13$)	175	170	205	195	185	182	150	175	190	180	195	220	235

To perform Two Independent Samples *t*-Test for the data above:

1. **Create data file:** Enter the data in SPSS, with the variable “weight” takes up one column, and the sex variable for identifying whether the weight data was from male or female subject takes up another column. The “weight” is considered as the dependent, response or outcome variable, and the “sex” variable is the independent or factor variable. The two variables should be created in the way as seen in the data editor on the right. The sex variable takes on two possible values, 0 or 1. The value “0” for sex variable represents a female subject, and the value “1” for sex variable represents a male subject.
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 List and “sex” variable into the Factor List 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 .615 and .727 from Shapiro-Wilk test of normality are both greater than 0.05 which imply that it is acceptable to assume that the weight distributions for male and female populations are both normal (or bell-shaped).

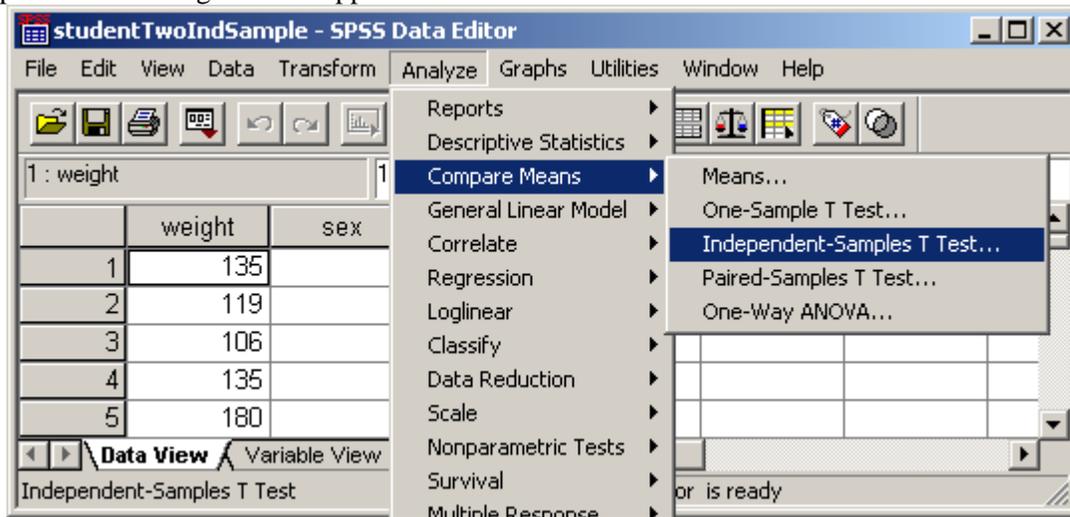
Tests of Normality

sex	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
WEIGHT Female	.165	9	.200*	.946	9	.615
Male	.162	13	.200*	.961	13	.727

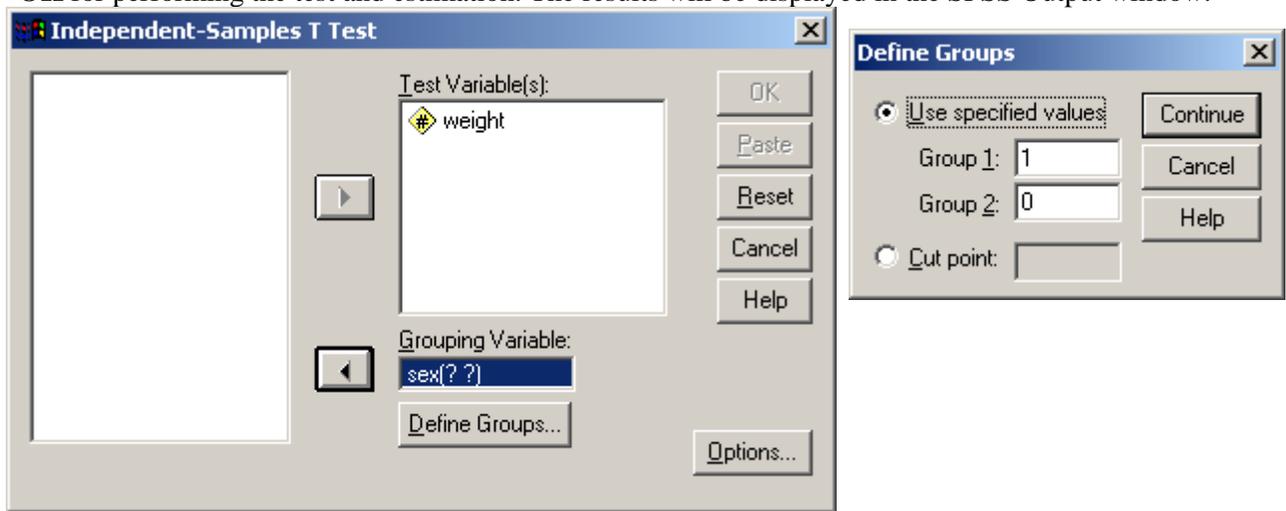
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

- To perform the two independent samples t-test**, first click through the menu selections **Analyze / Compare Means / Independent Samples T Test...** as in the following picture, and the Independent-Samples T Test dialog box will appear on the screen.



Select the variable “weight” to be analyzed into the Test Variable box. Click **Define Groups ...** and enter the group variable values for identifying groups to be compared. Enter **1** in Group 1 box, and enter **0** for Group 2 box, since for the sex variable, 0 means female and 1 means male. 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 Levene’s Test for Equal variances yields a p-value of **.857**. This means that the difference between the variances is statistically insignificant and one should use the statistics in the **first row**. The p-value **.000**, less than 0.05, indicates that there is significant different between average weights for female and male. The 95% confidence interval for the difference between two means is **(33.47, 74.75)**. (This is for the average weight of male minus average weight of female, because we have defined Group 1 as male and Group 2 as female in step 4.)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
WEIGHT	Equal variances assumed	.033	.857	5.468	20	.000	54.11	9.90	33.47	74.75
	Equal variances not assumed			5.382	16.374	.000	54.11	10.05	32.84	75.38