Testing Hypotheses about Means and Independence

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.

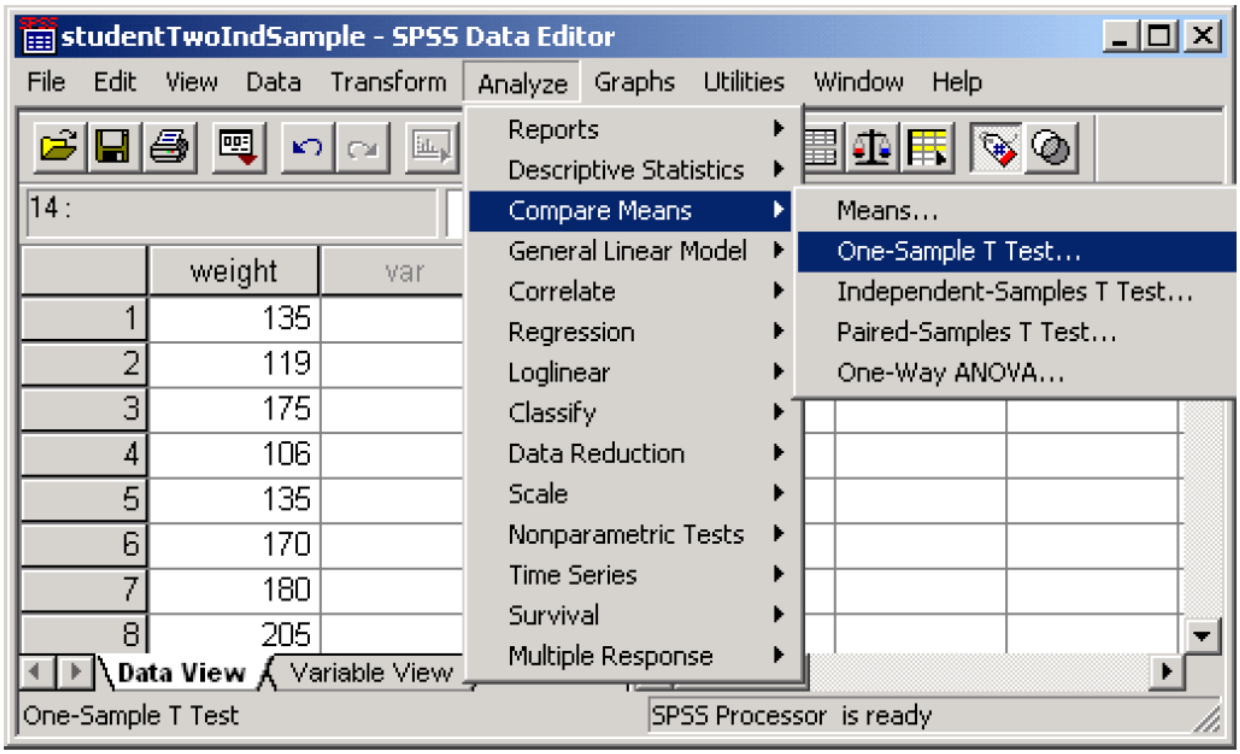
Example: To test whether the average weight of student population is different from 140 lb.

Data: A random sample of 22 students' weights from student population.

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. **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.



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

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.

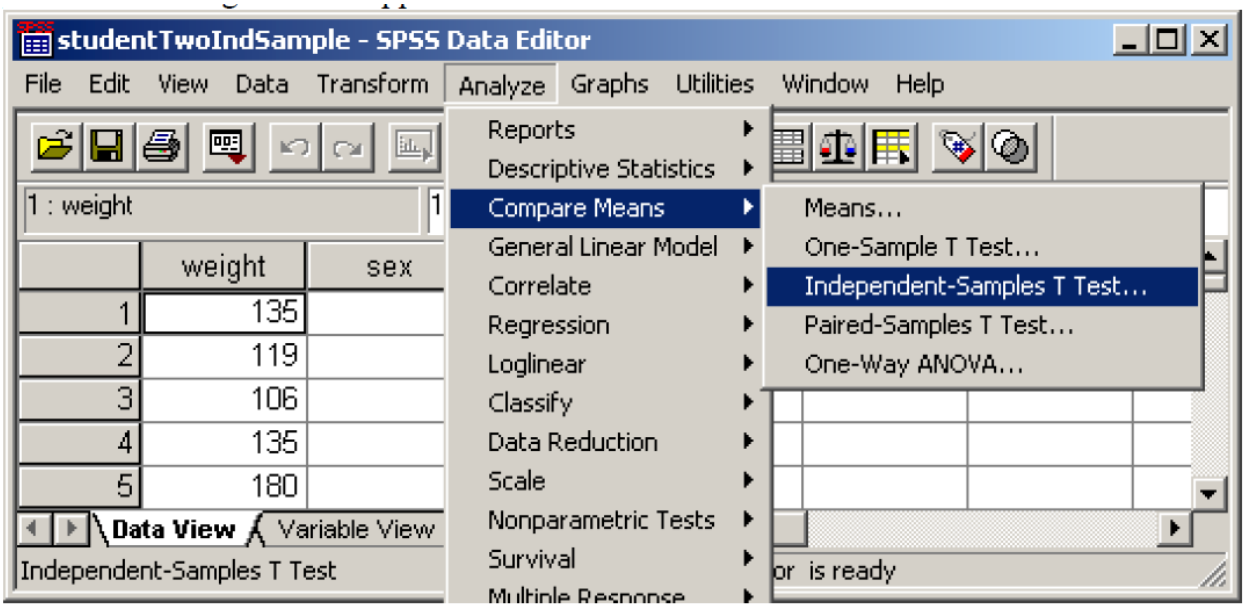
Example: Comparing average weights between male and female subjects using two independent samples.

Data: Two independent random samples of weights, one from male population and one from female population.

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 Gender 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 "Gender" variable is the independent or factor variable.
   The Gender variable takes on two possible values, 0 or 1. The value "0" for gender variable represents a female subject, and the value "1" for gender variable represents a male subject.
2. **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.



Interpret SPSS Output: 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)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error 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

To see the results of the t-test for the difference in the two means, find the p-value for the test. The p-value is labeled as "Sig." in the SPSS output ("Sig." stands for significance level). To find the correct "Sig.", look in the section of the "Independent Samples Test" output labeled "t-test for Equality of Means" and you will find a column labeled "Sig. (2-tailed)." This is the correct column, not the column labeled "Sig." in the section of the "Levene's Test for Equality of Variances" section. Finally, read the "Sig." value in the second row, the row labeled "Equal variances not assumed". We will use the second row since we almost never have any reason to think a *priori* that the amount of variation within each group will be the same (the p-value in the two rows is usually almost the same anyway).