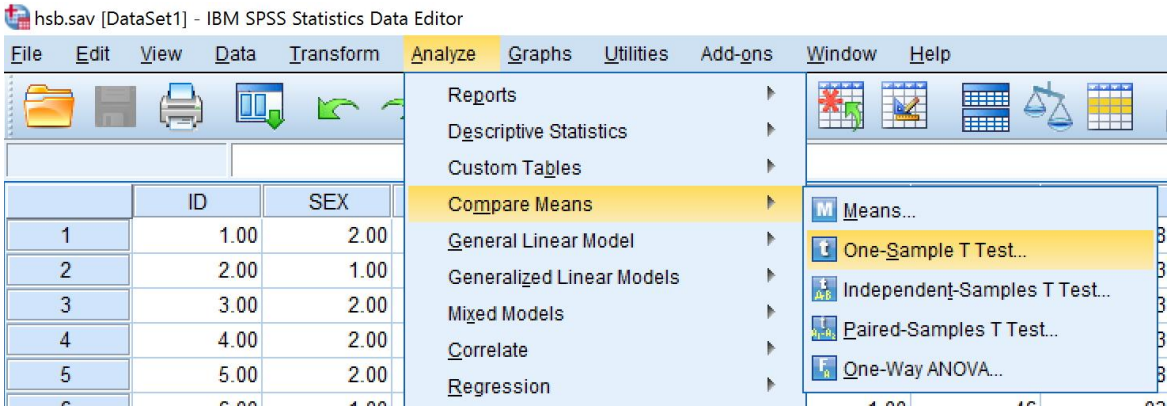
60080079 Introduction to Statistical Methods
Semester 2 2023-2024
Handout 6

An Introduction to Mean Comparisons in SPSS

1. One Sample

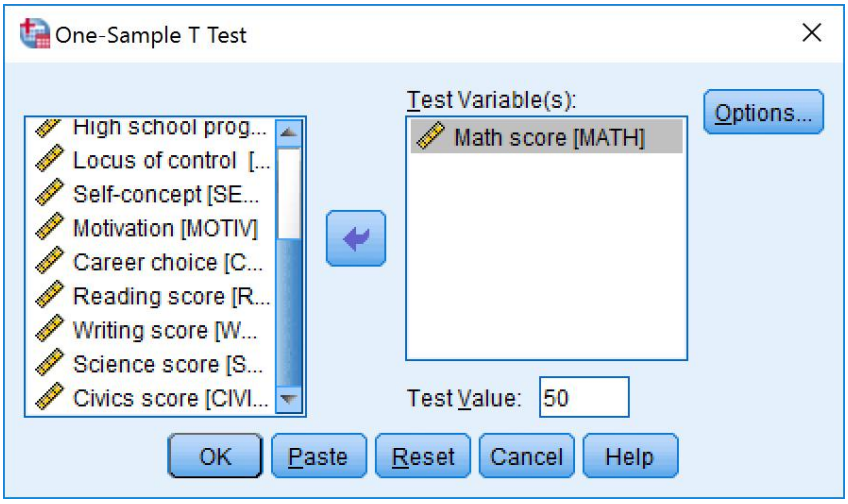
We are interested in testing whether the mean **Math score** is equal to 50, as in, $\mu = 50$. For illustration purposes, let $\alpha = .10$.

Analyze → Compare Means → One-Sample T-Test.



In the **One-Sample T Test** dialog box, click the variable/s to be analyzed in the Test Variable(s) box.

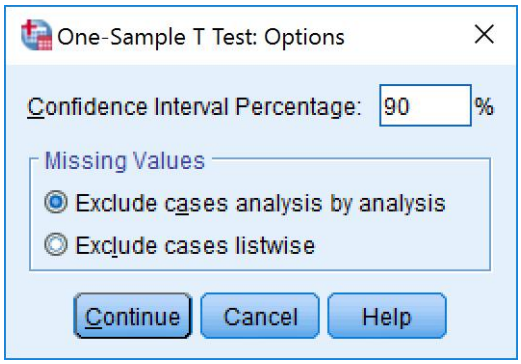
The **Test Value** box can be used to specify the value of the μ_0 under the null hypothesis (Default: $\mu_0 = 0$).



In addition to hypothesis testing, this function can automatically the corresponding 95% constructs confidence interval. To change the confidence level, use the **Options** button.

The **Confidence Interval Percentage** box allows for the confidence level to be adjusted.

In our example, we are interested in creating a 90% confidence interval for μ.



Hit **Continue** then **OK**.

We should get the following output:

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Math score	600	51.8490	9.41474	.38436

One-Sample Test

	Test Value = 50					
					90% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Math score	4.811	599	.000	1.84900	1.2158	2.4822

The p-value is close to zero so we can reject the null hypothesis at $\alpha = .10$.

Note 1: The default in SPSS is to carry out a two-tailed test. If the test is one-tailed, the p-value (Sig[nificance]) needs to be divided by 2.

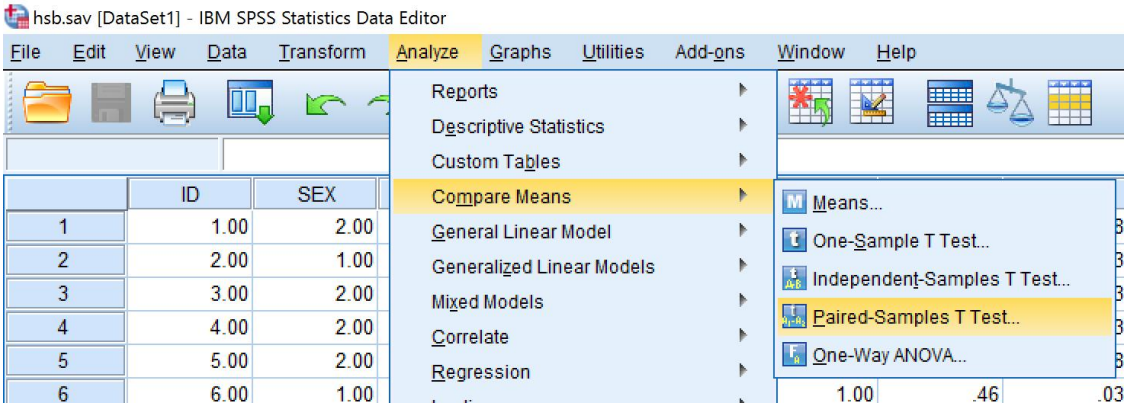
Note 2: The confidence interval is constructed for $\mu - \mu_0$ so we need to add back μ_0 to get the correct confidence interval for μ.

In this example, the 90% confidence interval for μ is (51.22, 52.48).

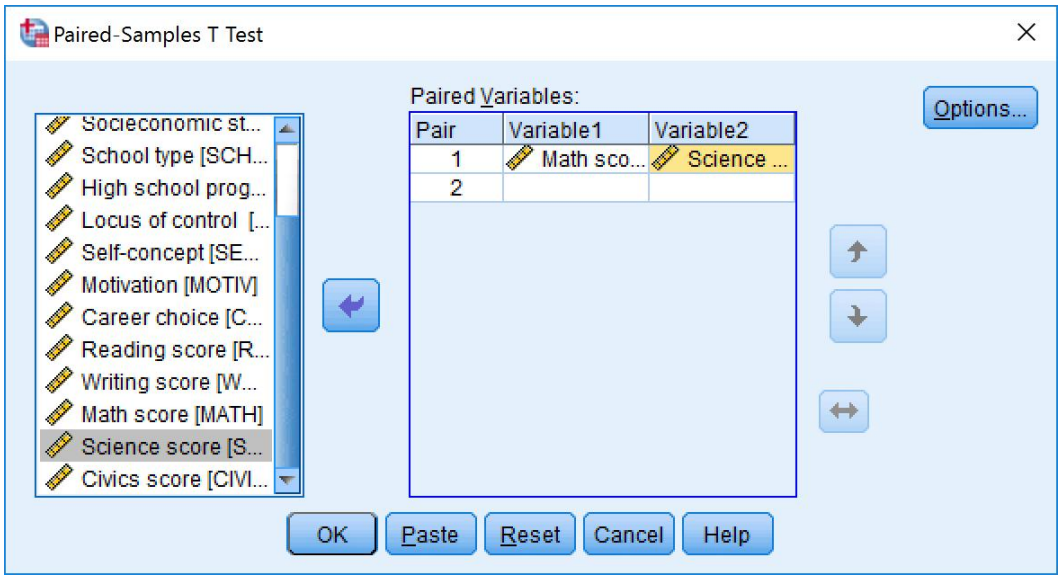
2. Two Dependent Samples

We want to test whether or not the students performed similarly in **Math** and **Science**.

Analyze → Compare Means → Paired-Samples T Test.



In the **Paired-Samples T Test** dialog box, choose the pair of variables to be analyzed.



This function has the same **Option** as the **One-Sample T Test**.

Click **OK** to run the analysis.

Below is the output from this analysis.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Math score	51.8490	600	9.41474	.38436
	Science score	51.7633	600	9.70618	.39625

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Math score & Science score	600	.650	.000

Paired Samples Test

		Paired Differences			
		Mean	Std. Deviation	Std. Error Mean	90'
Pair 1	Math score - Science score	.08567	8.00864	.32695	

Test

s				
90% Confidence Interval of the Difference				
Lower	Upper	t	df	Sig. (2-tailed)
-.45295	.62429	.262	599	.793

Based on the p-value is 0.793 so retain the null hypothesis that $\mu_M = \mu_S$.

The 90% confidence interval for $\mu_M = \mu_S$ is (-0.45, 0.62).

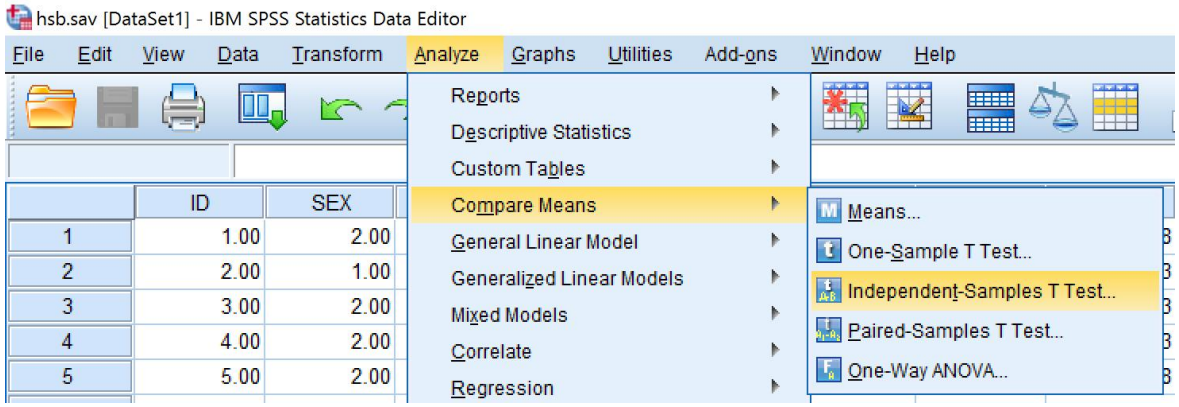
Note: The default null hypothesis for this analysis is $\mu_1 = \mu_2$ or $\mu_1 - \mu_2 = 0$. If a more general hypothesis is involved, as in, $\mu_1 - \mu_2 = c$, where $c \neq 0$, we can carry out the test by rewriting the null hypothesis as $\mu_1 - \mu_2 - c = 0$, which is equivalent to $\mu_1 - (\mu_2 + c) = 0$.

This means we have to add the constant c to X_2, as in, $X_2^* = X_2 + c$, before carrying out the analysis using X_1 and X_2^*, instead of the original X_2.

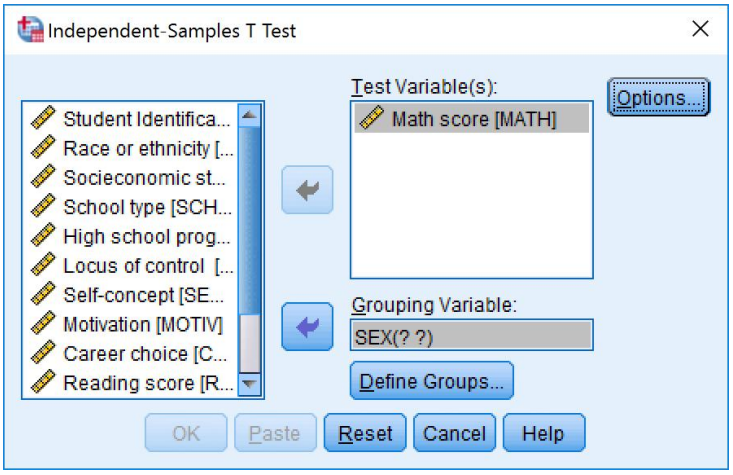
3. Two Independent Samples

We want to examine whether or not the **male** and **female** students performed similarly in **Math**.

Analyze → Compare Means → Independent-Samples T Test.

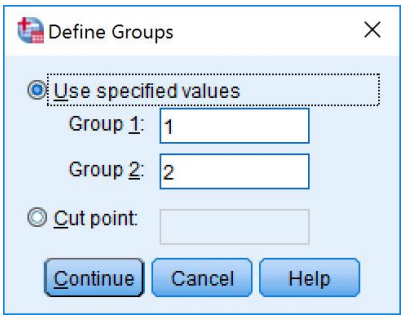


In the **Independent-Samples T Test** dialog box, click the variable to be analyzed in the **Test Variable(s)** box, and the group membership variable in the **Grouping Variable** box.



SPSS needs to know which values of the group membership variable will be assigned to **Group 1** and **Group 2**. To do this, click the **Define Groups** button.

In this example, we can let Sex = 1 to be **Group 1** and Sex = 2 to be **Group 2** in the **Define Groups** dialog box.



The **Option** button can also be used to adjust the confidence level.

Click **Continue** then **OK**.

Below is the output from this analysis.

Group Statistics

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Math score	Male	273	52.3454	9.80706	.59355
	Female	327	51.4346	9.06855	.50149

Independent Samples Te

		Levene's Test for Equality of Variances			
		F	Sig.	t	df
Math score	Equal variances assumed	1.088	.297	1.181	598
	Equal variances not assumed			1.172	560.594

Test

t-test for Equality of Means				
			95% Confidence Interval of the Difference	
Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
.238	.91086	.77159	-.60449	2.42622
.242	.91086	.77704	-.61541	2.43714

Note: Results for the analyses with and without the equal variances assumption are automatically provided.

In this example, although the degrees of freedoms are not the same, the resulting p-values are very similar, and lead to the same decision – retain the null hypothesis.

The confidence intervals are also very similar.