MANN-WHITNEY TEST OR U TEST

Dr. SANGEETA MOHANTY

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Introduction

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Case Analysis-1

Problem

The zonal manager of Amul India Company wants to compare the average sales of Amul Spray in two districts A and B.

The hypotheses for the analysis are:

Null hypothesis-H_0: The average sales in two districts are equal

Alternative Hypothesis- H_1: The average sales in two districts are not equal **(two tailed test)**

Input Data

The data collected randomly from 25 retail shops of two districts A and B are given in the following table. The test variable is the average sales in kg. and it should be numeric data. The district is a group variable or coded variable. (Code = 1 for district A and code = 2 for district B)

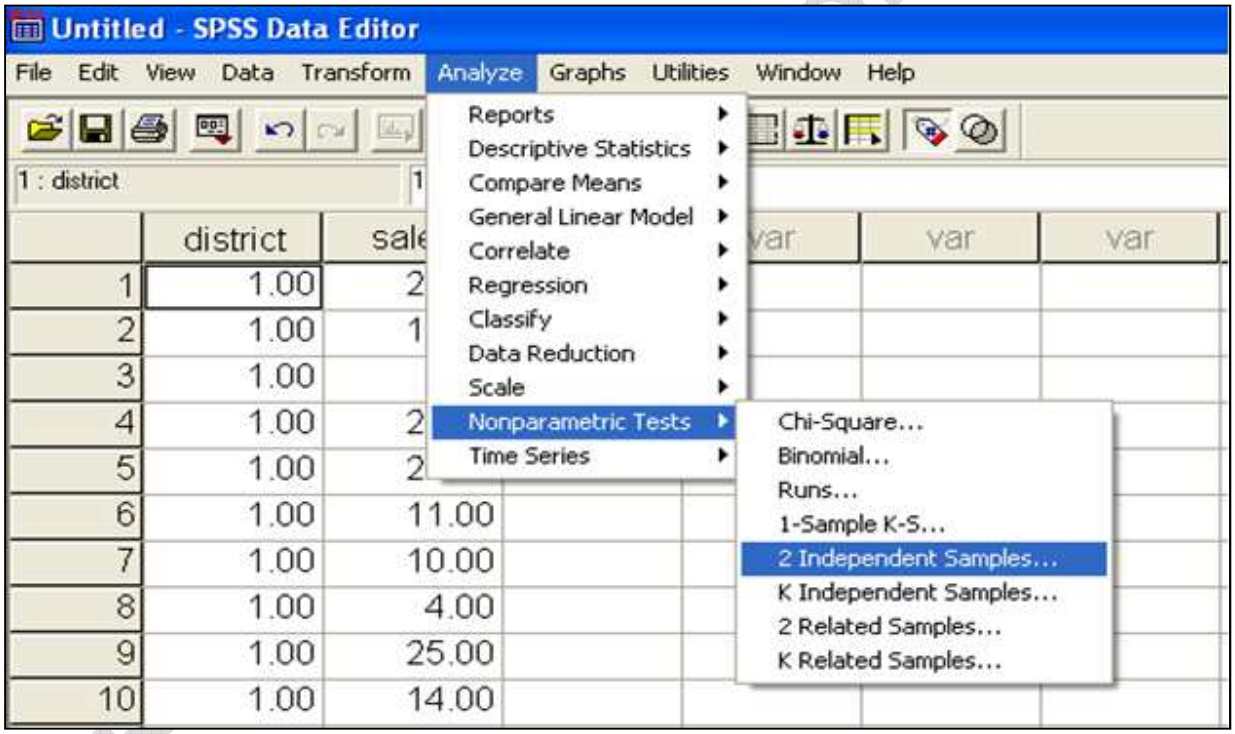
Table-1: Input Data

Serial Number	Districts (Code = 1 for A and code = 2 for B)	Sales in kg.
1	1	28
2	1	12
3	1	9
4	1	25
5	1	28
6	1	11
7	1	10
8	1	4
9	1	25
10	1	14
11	1	19
12	1	18
13	1	32
14	2	34
15	2	21

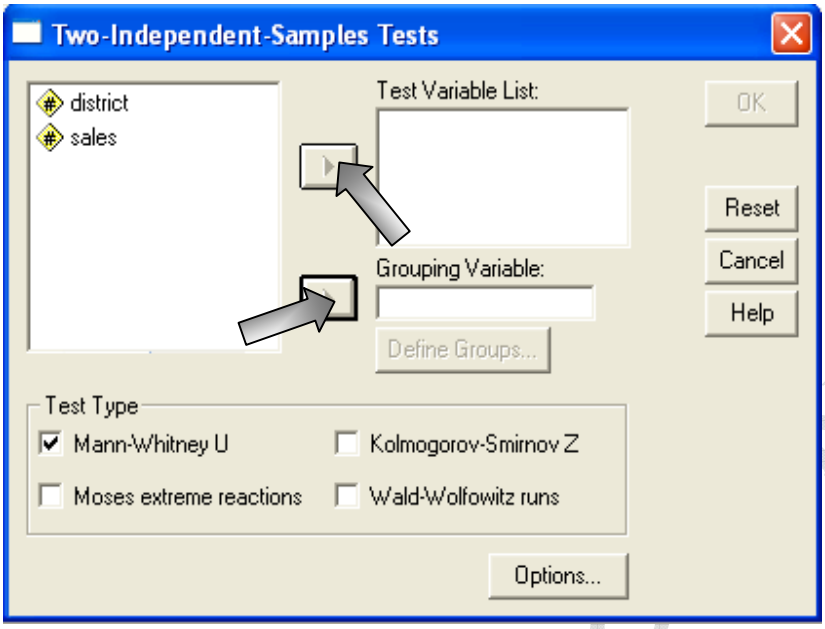
16	2	17
17	2	18
18	2	19
19	2	8
20	2	9
21	2	11
22	2	12
23	2	31
24	2	35
25	2	36

Performing the Analysis with SPSS

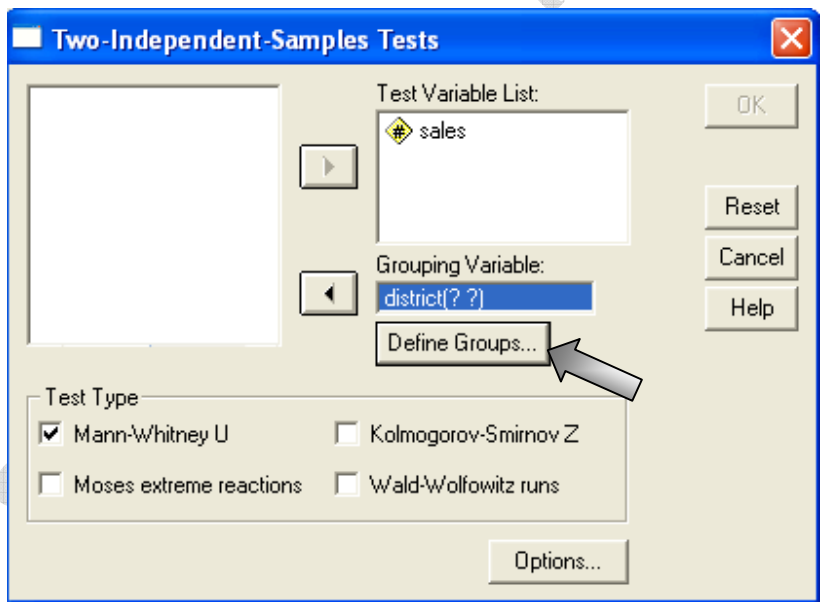
For SPSS Version 11, click on **Analyze** → **Non parametric tests** → **2- Independent Samples.** This will bring up the SPSS screen dialogue box as shown below.

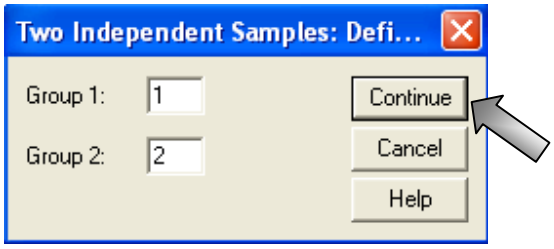


After clicking **2- Independent Samples,** this will bring up the following SPSS screen dialogue box.

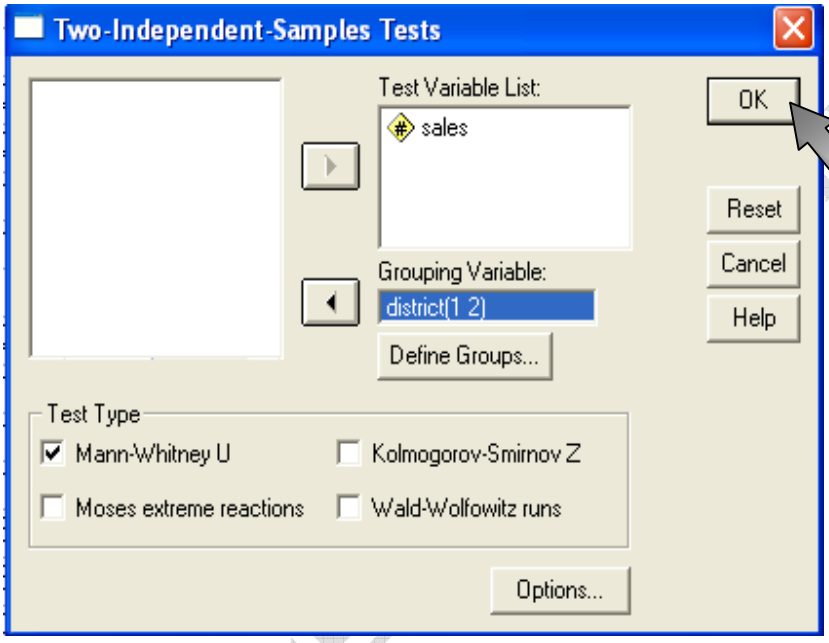


SELECT THE VARIABLE AND MOVE IT TO THE TEST VARIABLE LIST BOX. SELECT THE CODED VARIABLE AND MOVE IT TO GROUPING VARIABLE BOX.





Define the groups of values of the grouping variable by clicking on **Define Groups** just below the grouping variable box. This will bring up the **dialogue box** as shown above. Code 1 is used for district A and code 2 is used for district B. Now click button **Continue.** This will bring **Two-independent sample- tests** dialogue box as shown below.



Now, click on **Mann-Whitney U** and then **OK.**

SPSS Output

The SPSS outputs of the analysis are depicted in table-2 and table-3.

Mann-Whitney Test

Table-2: Ranks

	District	N	Mean Rank	Sum of Ranks
Sales	1.00	13	12.12	157.50
	2.00	12	13.96	167.50
	Total	25		

Table-3: Test Statistics

	Sales
Mann-Whitney U	66.500
Wilcoxon W	157.500
Z	-.626
Asymp. Sig. (2-tailed)	.531
Exact Sig. [2*(1-tailed Sig.)]	.538

a Not corrected for ties.

b Grouping Variable: district

From the output, Mann-Whitney U = 66.500

Decision

Reject the null hypothesis if p-value is (Asymp. Sig. (2-tailed)) ≤ 0.05

Interpretation

The p-value is in this case is 0.531, which is higher than 0.05 (5% level of significance). So, there is not much evidence to reject the null hypothesis at 5% level of significance. In other words the average sales in two districts are equal.

Case Analysis-2

Problem

A pharmaceutical company wants to test the effectiveness of its drug A in reducing the weights. The purpose is to test the claim that drug A can reduce the weight more effectively as compared to another drug B existing in the market.

The hypotheses for the analysis are:

Null hypothesis-H_0: The average decrease in weights using drugs A and B are equal.

Alternative Hypothesis- H_1: The average decrease in weight using drug A is less than the average decrease in weight using drug B. **(single tailed test)**

Input Data

For the purpose of testing, 30 people were randomly selected and 17 of them were subjected to drug A and 13 with drug B. The decrease in weight in kg. is given below.

Table-1: Input Data

Respondent Number.	Drugs (Code = 1 for A and code = 2 for B)	Decrease in weight in kg.
1	1	8
2	1	5
3	1	6
4	1	2
5	1	3
6	1	9
7	1	7
8	1	4
9	1	5
10	1	2
11	1	1
12	1	3

13	1	6
14	1	5
15	1	4
16	1	5
17	1	6
18	2	5
19	2	8
20	2	9
21	2	10
22	2	11
23	2	2
24	2	3
25	2	9
26	2	8
27	2	4
28	2	8
29	2	2
30	2	3

SPSS OUTPUT

MANN-WHITNEY TEST

TABLE-2: RANKS

	DRUG	N	MEAN RANK	SUM OF RANKS
WEIGHT	1.00	17	13.74	233.50
	2.00	13	17.81	231.50
	TOTAL	30		

TABLE-3: TEST STATISTICS

	VAR00002
MANN-WHITNEY U	80.500
WILCOXON W	233.500
Z	-1.264
ASYMP. SIG. (2-TAILED)	.206
EXACT SIG. [2*(1-TAILED SIG.)]	.213

A NOT CORRECTED FOR TIES.

B GROUPING VARIABLE: DRUG

FROM THE OUTPUT, MANN-WHITNEY U = 80.500

DECISION

REJECT THE NULL HYPOTHESIS IF P-VALUE IS (ASYMP. SIG. (2-TAILED)) ≤ 0.05

THE P-VALUE FOR ONE-TAILED TEST WOULD BE $\frac{(\text{Asymp.Sig.}(2-\text{tailed})}{2}$.

INTERPRETATION

THE P-VALUE IS $\frac{0.206}{2} = 0.013$ IS LESS THAN 0.05 (5% LEVEL OF SIGNIFICANCE). SO, WE REJECT THE NULL HYPOTHESIS AND ACCEPT THE ALTERNATIVE

hypothesis at 5% level of significance. It can be concluded that the drug A can reduce the weight more effectively.

SPSS command

1. Click on ANALYZE at the SPSS menu bar (in older versions of SPSS, click on STATISTICS instead of ANALYZE).
2. Click on NONPARAMETRIC TEST followed by 2 INDEPENDENT SAMPLES.
3. Select the test variable and move it TEST VARIABLE LIST box. Similarly select the coded variable and move it to GROUPING VARIABLE BOX followed by DEFINE GROUPS. Fill in the box with appropriate codes and click CONTINUE.
4. Click MANN-WHITNEY U TEST.
5. Select OK of the main dialogue box.