

WILCOXON SIGNED RANK TEST FOR PAIRED SAMPLE



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MANN WHITNEY U TEST ASSUMES THE SAMPLES TO BE INDEPENDENT OF EACH OTHER. BUT, THE CONDITION MAY NOT HOLD IN REALITY; AS IN MANY CASES THE SAMPLE OBSERVATIONS SEEM TO BE RELATED PAIR WISE. WILCOXON SIGNED RANK TEST IS USED TO TEST THE EQUALITY OF POPULATION MEANS FOR PAIRED SAMPLE. THE TEST IS AN ALTERNATIVE TO PAIRED 'T' TEST FOR SMALL SAMPLES NOT ASSUMING THE NORMALITY CONDITION OF THE POPULATION.

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INTRODUCTION

MANN WHITNEY U TEST ASSUMES THE SAMPLES TO BE INDEPENDENT OF EACH OTHER. BUT, THE CONDITION MAY NOT HOLD IN REALITY; AS IN MANY CASES THE SAMPLE OBSERVATIONS SEEM TO BE RELATED PAIR WISE. WILCOXON SIGNED RANK TEST IS USED TO TEST THE EQUALITY OF POPULATION MEANS FOR PAIRED SAMPLE. THE TEST IS AN ALTERNATIVE TO PAIRED 'T' TEST FOR SMALL SAMPLES NOT ASSUMING THE NORMALITY CONDITION OF THE POPULATION.

CASE ANALYSIS-1

PROBLEM

THE HR MANAGER OF A COMPANY IS INTERESTED TO ASSESS THE PERFORMANCE OF THE EMPLOYEES ON THE BASIS OF A TRAINING PROGRAMME IMPARTED. TWENTY EMPLOYEES WERE SELECTED AND SENT FOR THE TRAINING. THE APPRAISAL SCORES BEFORE AND AFTER THE TRAINING ARE GIVEN IN TABLE-1.

THE HYPOTHESES FOR THE ANALYSIS ARE:

NULL HYPOTHESIS- H_0 : THERE IS NO CHANGE IN APPRAISAL SCORES AFTER TRAINING.

ALTERNATIVE HYPOTHESIS- H_1 : THERE IS A CHANGE IN APPRAISAL SCORES BECAUSE OF TRAINING (TWO TAILED TEST)

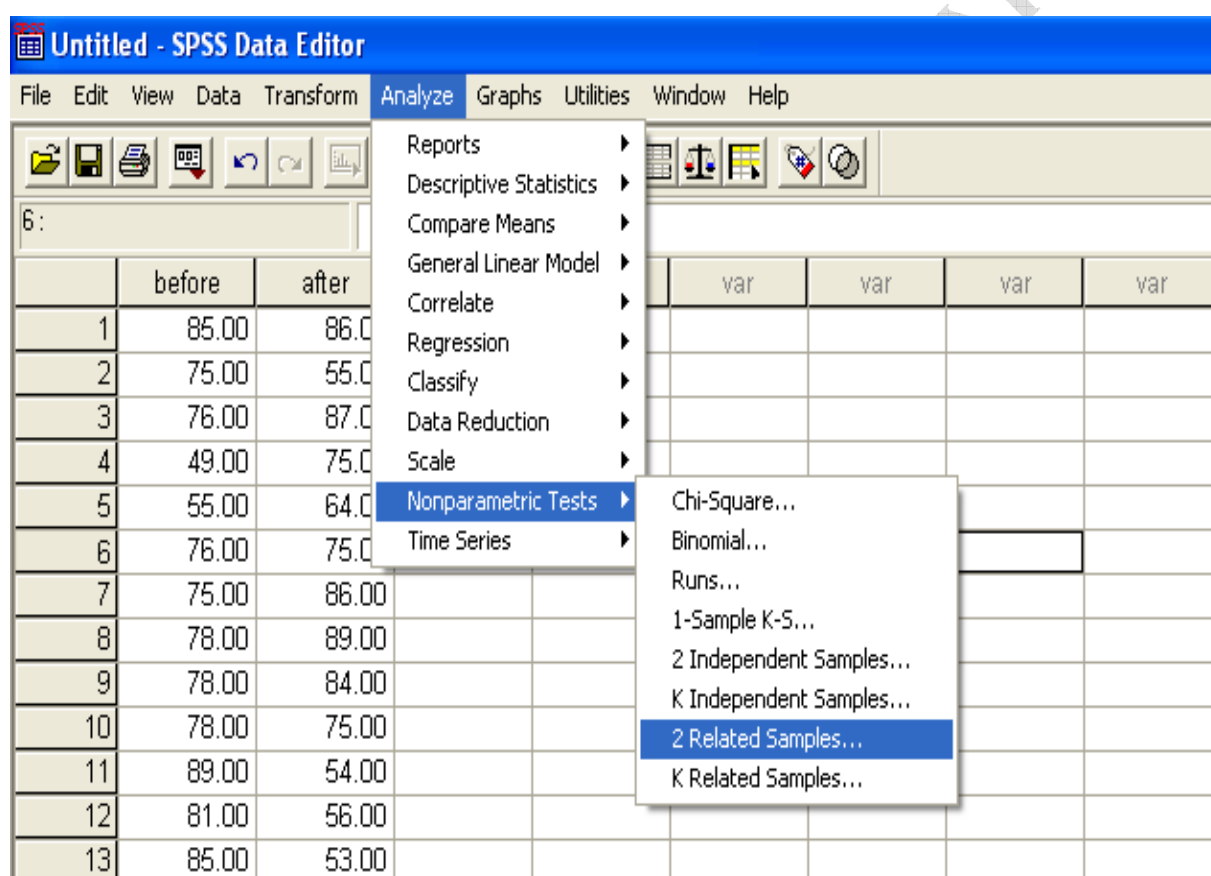
TABLE-1: INPUT DATA

EMPLOYEE NUMBER	SCORE BEFORE TRAINING	SCORE AFTER TRAINING
1	85	86
2	75	55
3	76	87
4	49	75
5	55	64
6	76	75
7	75	86
8	78	89
9	78	84
10	78	75
11	89	54
12	81	56
13	85	53
14	56	52
15	75	88

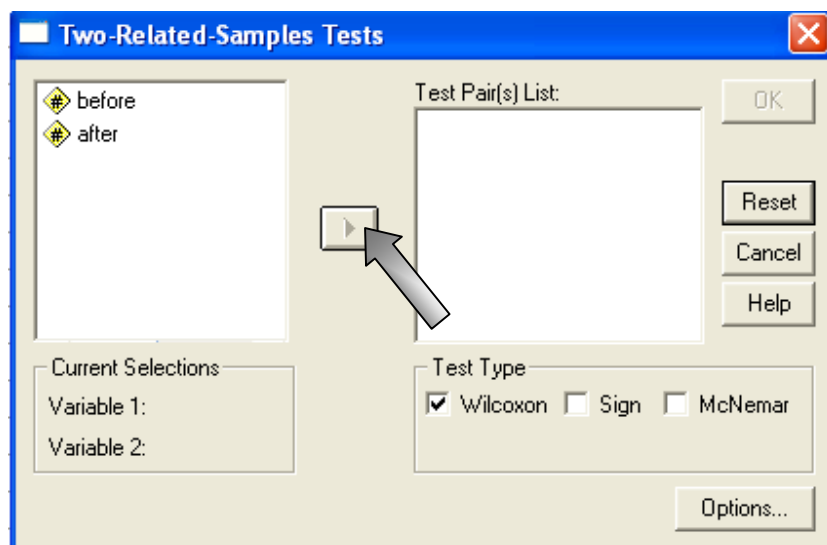
16	68	65
17	69	64
18	82	99
19	81	68
20	82	99

PERFORMING THE ANALYSIS WITH SPSS

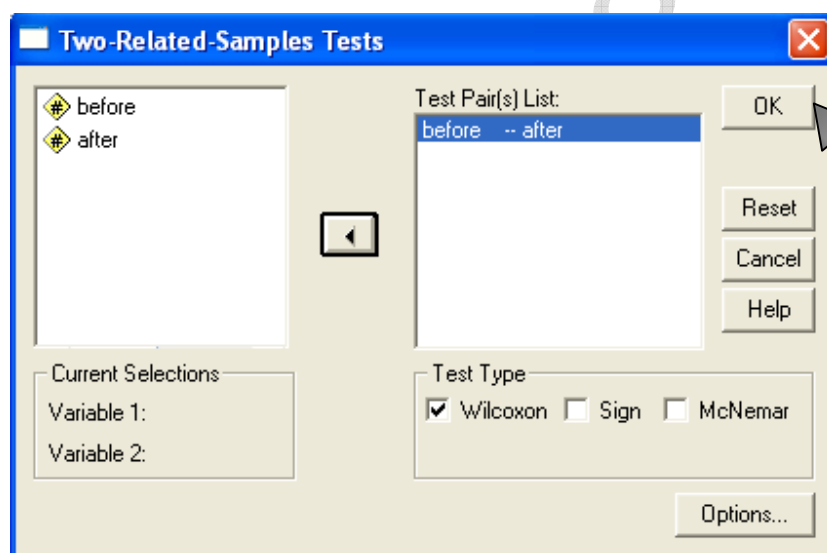
FOR SPSS VERSION 11, CLICK ON **ANALYZE** → **NON PARAMETRIC TESTS** → **2-RELATED SAMPLES**. THIS WILL BRING UP THE FOLLOWING SPSS SCREEN DIALOGUE BOX.



AFTER CLICKING **2- RELATED SAMPLES**, THIS WILL BRING UP THE SPSS SCREEN DIALOGUE BOX AS SHOWN BELOW.



SELECT THE VARIABLE AND MOVE THEM TO THE **TEST PAIR(S) LIST** BOX.



NOW, CLICK ON **WILCOXON** AND THEN **OK**.

SPSS OUTPUT

THE SPSS OUTPUTS OF THE ANALYSIS ARE DEPICTED IN TABLE-2 AND TABLE-3.

WILCOXON SIGNED RANKS TEST

TABLE-2: RANKS

		N	MEAN RANK	SUM OF RANKS
AFTER - BEFORE	NEGATIVE	10	10.40	104.00
	POSITIVE	10	10.60	106.00
	TIES	0		
	TOTAL	20		

A AFTER < BEFORE

B AFTER > BEFORE

C BEFORE = AFTER

TABLE-3: TEST STATISTICS

	AFTER - BEFORE
Z	-.037
ASYMP. SIG. (2-TAILED)	.970

A BASED ON NEGATIVE RANKS.

B WILCOXON SIGNED RANKS TEST

DECISION

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

INTERPRETATION

THE Z VALUE IS (-0.037) AND HAS A P-VALUE OF 0.970. THE P-VALUE IS MORE THAN 0.05 (5% LEVEL OF SIGNIFICANCE). THEREFORE THE NULL HYPOTHESIS IS ACCEPTED AND ALTERNATIVE HYPOTHESIS IS REJECTED. IT IS CONCLUDED THAT THERE IS NO CHANGE IN APPRAISAL SCORES AFTER TRAINING PROGRAM.

CASE ANALYSIS-2

PROBLEM

A BUSINESS SCHOOL CONDUCTED A PRE PLACEMENT TRAINING BY TWO EXPERTS X AND Y. TWENTY SECOND YEAR STUDENTS WERE EXPLORED TO EACH OF THESE TRAINING AND THEIR AVERAGE MARK WERE RECORDED. THE PROBLEM IS TO THE HYPOTHESIS THAT THE TRAINER X IS MORE EFFECTIVE AS COMPARED TO Y OR NOT.

THE HYPOTHESES FOR THE ANALYSIS ARE:

NULL HYPOTHESIS- H_0 : THERE IS NO DIFFERENCE IN AVERAGE MARKS DUE TO TWO DIFFERENT TRAINERS X AND Y.

ALTERNATIVE HYPOTHESIS- H_1 : THE AVERAGE MARKS DUE TO TRAINER X IS MORE THAN THE AVERAGE MARK DUE TO TRAINER Y. (ONE TAILED TEST)

TABLE-1: INPUT DATA

STUDENT NUMBER	AVERAGE MARK (X)	AVERAGE MARK (Y)
1	66	65
2	59	69
3	58	68
4	89	64
5	78	37
6	75	78
7	74	79
8	62	81
9	65	82
10	39	32
11	86	85
12	95	39

13	65	67
14	35	84
15	65	35
16	64	44
17	65	41
18	68	42
19	63	45
20	62	32

SPSS OUTPUT

TABLE-2: RANKS

		N	MEAN RANK	SUM OF RANKS
Y- X	NEGATIVE	12	12.00	144.00
	POSITIVE	8	8.25	66.00
	TIES	0		
	TOTAL	20		

A Y < X
 B Y > X
 C X = Y

TABLE-3: TEST STATISTICS

	Y - X
Z	-1.456
ASYMP. SIG. (2-TAILED)	.145

A BASED ON POSITIVE RANKS.
 B WILCOXON SIGNED RANKS TEST

DECISION

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

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

INTERPRETATION

THE Z VALUE IS (-1.456) AND HAS A P-VALUE OF $\frac{0.145}{2} = 0.0725$. THE P-VALUE IS MORE THAN 0.05 (5% LEVEL OF SIGNIFICANCE). THEREFORE THE NULL HYPOTHESIS IS ACCEPTED AND ALTERNATIVE HYPOTHESIS IS REJECTED. IT IS CONCLUDED THAT TRAINER X IS NOT MORE EFFECTIVE THAN TRAINER Y.

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-RELATED SAMPLES.
3. SELECT THE VARIABLES SIMULTANEOUSLY AND MOVE THEM TO TEST PAIR(S) LIST BOX.
4. SELECT WILCOXON TEST.
5. CLICK OK OF THE MAIN DIALOGUE BOX.