2: several sample test.

→ 2 sample test =

used to evaluate the effectiveness of 2 treatments, 2 methods | 2 promotional strategy in business & economics.

1) Sign test =

It is based on the sign / pairs of obs.

The null hypo to be tested by the sign test is that $p = 1/2$.

In case of small samples the (prob) associated with the occurrence of a particular no. of +s & −s is determined with the help of binomial distri~ with $p = q = 1/2$, n is sample size & x is no. of fewer signs.

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Q
1) Following are the no. of tickets issued by 2 salesman in 11 days

x Salesman 1 :	7	10	14	12	6	9	11	13	7	6	10
y Salesman 2 :	10	13	14	11	10	7	15	11	10	9	8

Use the sign test at 1% of L of significance to test null hypo that on the avg the 2 salesman issued equal no. of tickets?

A) $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$

(x−y) − − ($\mu_1 = \mu_0$) + − + − + − − + (2 sample test)

n = 10.

(always fewer value) $x = 4$.

$p' = x/n = \frac{4}{10} = 0.4$

$P_0 = 1/2$, $q_0 = 1/2$

$$Z = \frac{p' - P_0}{\sqrt{\frac{P_0 q_0}{n}}} = \frac{0.4 - 0.5}{\sqrt{0.025/10}}$$

$= -0.63$

$\alpha = 0.01$

BCR ; $|Z| \geq Z_\alpha$.

$|Z| \geq 2.58$ (table value)

$0.63 \leq 2.58$ Accept

→ Wilcoxon matched pairs signed Rank test =

test procedures −

* Let di → difference score any matched pairs, we rank all the di's without regard their signs.
* To each rank prefix the sign of the difference
* If any di = 0, d/t it & reduce sample size
* If there are ties in some of the values of di, assign avg rank

to such pairs by arranging their rank positions test statistic, t is calculated which upto the smaller sum of like signed ranks.

- If cal value < or = the tabulated value, we reject the null hypo.

8) An expt is conducted to judge the effect of branchname on quality perceptions 16 subs are recruited for the purpose & asked to test & combare 2 sample of product on a set of scale items judged to the ordinal. follow. data -

test the hypo using wilcoxon matched pair test, that there is no diffrnce b/w the perceed quality of 2 samples, are 5% L of 5?

pair	Branch A (x)	Branch B (y)	(x-y) di
1	73	51	22
2	43	41	2
3	47	43	4
4	53	41	12
5	58	47	11
6	47	32	15
7	52	24	28
8	38	38	0
9	38	43	-5
10	61	53	8
11	56	52	4
12	56	57	-1
13	34	44	-10
14	55	57	-2
15	65	40	25
16.	75	68	7

a) H_0 : there is no diffrnce b/w perceed quality 2 8

H_1 : diffrnce b/w perceed q of 25.

rank of di.	Sign. +	Sign. -
13	13	
2.5	2.5	
4.5	4.5	
11	11	
10	10	
12	12	
15	15	
6		6
8	8	
4.5	4.5	
9		9
2.5		2.5
14	14	
7	7	
	101.5	-18.5

(Lowest value)

T = 18.5.

$\alpha = 0.05$, $n = 15$, $T_\alpha = 25$

$18 < 25$. reject

Note

If $n \geq 25$, the sampling distrin of T is approximately normal with

$\bar{T} = \frac{n(n+1)}{4}$ & $S_T = \sqrt{\frac{n(n+1)(2n+1)}{24}}$

where n = no of matched pairs − no of discarded pairs.

$$Z = \frac{T - \frac{n(n+1)}{4}}{\sqrt{\frac{n(n+1)(2n+1)}{24}}}$$

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→ **Wald-Wolfowitz test** (test for randomness)

used for testing the null hypo- that the 2 (P) follow identical distrin.

1) A sample of 10 students each from boys & girls revealed that their monthly expenditure on stationery as follows —

Boys : 10 12 15 20 17 14 11 13 25 18

girls : 12 14 15 8 18 22 20 18 10 15

using wald-wolfowitz test, verify that at $\alpha = 0.05$, the 2 (P) have identical distrin

A) $n_1 = 10$, $n_2 = 10$.

H_0 : (P) have identical distri-

Ascending order,

8(G1), 10(B), 10(G1), 11(B), 12(G1), 13(B), 14(G1), 14(B), 15(G1), 15(B), 15(B), 17(B), 18(G1), 18(B), 18(G1), 20(B), 20(G1), 22(G1), 25(B)

no of run , $R = 10$. (pass)

mean $M_R = \frac{2n_1n_2}{n_1+n_2} + 1 = \frac{2 \times 10 \times 10}{20} + 1 = 10 + 1 = 11$

var $\sigma_R^2 = \frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1+n_2)^2(n_1+n_2-1)}$

$= \frac{90}{19} = 4.74$. $\sigma = \sqrt{4.74}$

$Z = \frac{R - M_R}{\sigma_R} = \frac{10 - 11}{\sqrt{4.74}} = -0.458$

If $\alpha = 0.05$, BCR , $Z \leq -Z_\alpha$.

$Z \leq -1.645$

$-0.458 > -1.645$.

Accept