Mann and whitney

Another procedure for testing the null hypothesis of equal popⁿ location parameter is one proposed by mann and whitney test

Assumptions:

The data consist of a random sample of observations $X_1, X_2, \ldots X_n$ from population 1 and other random random Sample of observation $Y_1, Y_2 \ldots Y_n$ from popⁿ two

2 The two Samples are independent
3 The variable observed is continuous random variable
4 The measurement Scale is atleast ordinal
5 The distⁿ function of the two popⁿ differ only with respect to location if they differ at all

Procedure

Hypothesis

for two sided

H_0: The popⁿ have identical distⁿ $\mu_x = \mu_y$

H_1: The popⁿ differe with respect to location $\mu_x \neq \mu_y$

For one sided

⇒ H_0:- The popⁿ have identical distⁿ $\mu_x \geq \mu_y$

H_1 The X tend to be smaller then Y $\mu_x < \mu_y$

⇒ H_0 :- The popⁿ have idential distⁿ $\mu_x \leq \mu_y$

H_1 :- The X tend to be ~~smaller~~ larger then Y. $\mu_x > \mu_y$

α

Test - Statistics:-

TO compute the observed of the test statistic we combine the two samples and rank all sample observation from smallest to larger.

We assign tied observation the mean of the rank position. We then sum the ranks of the observations from popⁿ (1)

$$T = S - \frac{n_1(n_1+1)}{2}$$

where S is the sum of the ranks assign to the sample observation from popⁿ 1

Decision Rule:-

When we test (a)

We reject H_0 for either a sufficiently small or a large value of T there fore we reject H_0 if the computed value of T is less then $W_{\frac{\alpha}{2}}$ or greater then $W_{1-\frac{\alpha}{2}}$

$T < W_{\frac{\alpha}{2}}$, $T > W_{1-\frac{\alpha}{2}}$

(b) We reject H_0 for ~~Sig~~ sufficiently small value of T. Reject H_0 if computed T is less than W_α.

$$T < W_\alpha$$

(c) We reject H_0 for sufficiently large value of T. Reject H_0 if computed T is large.

$$T > W_{1-\alpha}$$

$$W_{1-\alpha} = n_1 n_2 - W_\alpha$$

Example:-

From the following data we wish to see whether we can conclude on the basis of these data that the two represented population are different with respect to location and $\alpha = 0.05$

X	Rank	X	Rank	Y	Rank
2.2	2	8.2	22	1.7	1
4.1	6	8.7	23	2.4	3
4.2	7	9.4	24	3.3	4
5	9.5	9.5	25	3.9	5
6.3	14	11.7	26	4.3	8
6.8	16	11.9	27	5	9.5
6.9	17			5.1	11
7.1	18			5.4	12
7.4	19.5			5.8	13
7.4	19.5			6.6	15
7.4	21				

11.10

11.9

Total of Rank of X = 296.5

H_0: The two pop^n are identical $F_X = F_Y$

H_1: The two pop^n differs with respect to location $F_X \neq F_Y$

$$T = S - \frac{n_1(n_1+1)}{2}$$

$$= 296.5 - \frac{17(17+1)}{2}$$

$$T = 143.5$$

$S_2 = \cancel{81.5} \quad 81.5 - 55 = \quad 26.5 = 46$

$$W_{1-\frac{\alpha}{2}} = 124$$

calculated = 143.5

if $T > W_{1-\frac{\alpha}{2}}$ then we reject Ho

143.5 > 124 so we reject Ho. and conclude that two popn parameters are different