Non parametric test

1- Sample Sign test:-

(1) $H_0: M = M_0$

$H_1: M \neq M_0$

2. $H_0: M \leq M_0$

$H_1: M > M_0$

3. $H_0: M \geq M_0$

$H_1: M < M_0$

The sign test is perhaps the oldest test of all the ~~non~~ non-parametric procedures. Its use was reported as early as 1710 by Arbuthnott. It is also called the Sign test because we may convert the data for analysis to a series of +ve and -ve signs.

The test statistic then consists of either the number of +ve sign or the number of -ve signs

Assumptions:-
The sample available for analysis is a random sample from a pop^n with unknown median.

The variable of interest is on at least an ordinal scale.
The variable of interest is continuous and the n sample values are designated $x_1, x_2, x_3 \ldots x_n$.

General Procedure:-
Hypothesis:-

1. $H_0: M = M_0$
   $H_1: M \neq M_0$

2. $H_0: M \leq M_0$
   $H_1: M > M_0$

3. $H_0: M \geq M_0$
   $H_1: M < M_0$

Level of Significance:- $\alpha = 0.05$
Test-Statistics:- $X_i - M_0$
we focus on sign which signs are less that are our test-statistics and ignore 0 value and again count "n".

Decision:-
(a) Reject H_0 at the α level of significance if the probability when H_0 is true of observing as few ~~as~~ of the less frequently occurring sign in a random sample of size n is less or equal to $\frac{\alpha}{2}$

$$\left(K < k/n, 0.50\right) \leq \frac{\alpha}{2}$$

ritical value:-

$$P(K \leq 1 / 10, 0.50) \leq 0.025$$

we will reject Ho if the probability of observing one or less +ve signs when Ho is True is (less then of equal) ≤ 0.025 if fulfill this then reject.

$$P(k \leq 1 / 10, 0.50) = 0.0108$$

Since 0.0108 then 0.025 we reject Ho and conclude the popn median is not equal to 3.50

we can also test this with p-value:-

$$= 2(0.0108)$$
$$= 0.0216$$

$0.0216 \leq 0.05$ so reject

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The mean weight of a sample of a particular species of adult female monkey from a certain locality was 8.41 kg. Suppose that a sample of adult females of a the same species from another locality yield the weights 8.30, 9.50, 9.6 .... 9.30 can we conclude that the median weight of popⁿ from which this sample was drawn is greater than 8.41 kg. Use the One sample sign test at 0.05 level of Significance:-

1 H_0: $M \geq M_0 \Rightarrow M \geq 8.41$

H_1: $M < M_0 \Rightarrow M < 8.41$

2 Level of Significance: $\alpha = 0.05$

Sample	Weights	$X_i - M_0$
1	8.30	-
2	9.50	+
3	9.60	+
4	8.75	+
5	8.40	-
6	9.10	+
7	9.25	+
8	9.80	+
9	10.05	+
10	8.15	-
11	10	+
12	9.60	+
13	9.80	+
14	9.20	+
15	9.30	+

Test - Statistics:-

$n = 15$

$k = 3$

Since there are less -ve signs or difference then +ve difference so the value of test-statistic is $k = 3$ the number of difference with +ve sign.

Critical value

$P(k \leq 3 / 15, 0.50) \leq 0.05$