RUNS Test

1) H_0 : $R_i \sim$ independence
   H_1 : $R_i \nsim$ " "

2) write sequence of runs above & below mean

3) count the number of observation above the mean (n_1) and the no of observation below the mean (n_2)

   max no. of possible runs (N) $= n_1 + n_2$
   min no. of possible runs = one

   Total no. of runs (b)

4) calculate mean & variance of b

$$\mu_b = \frac{2n_1 + n_2}{N} + \frac{1}{2}$$

$$\sigma^2_b = \frac{2n_1 n_2 (2n_1 n_2 - N)}{N^2 (N-2)}$$ then n_1 or $n_2 > 20$

the distribution of b will be approximated by a N.D.

5) Standard normal statistics

$$z_0 = \frac{b - \mu_b}{\sigma_b}$$

6) $-z_{\alpha/2} \leq z_0 \leq z_{\alpha/2}$ = H_0 accepted.

   α = level of significance.

CHI SQUARE TEST

Class (n)	N (range)	O_i	$E_i = \frac{N}{n}$	$O_i - E_i$	$(O_i - E_i)^2$	$\frac{(O_i - E_i)^2}{E_i}$
1	0.01 – 0.10	2	3	-1	1	1/3
2	0.11 – 0.20	3	3	0	0	0
3	0.21 – 0.30	4	3	1	1	1/3
4	0.31 – 0.40	4	3	1	1	1/3
5	0.41 – 0.50	3	3	0	0	0

N = no. of random nos (interval)
n = class

KS Test

1) Arrange the sequence in ascending order.
2) Calculate:

$$D^+ = \max_{1 \leq i < N} \left\{ \frac{i}{N} - R_i \right\}$$

$$D^- = \max_{1 \leq i < N} \left\{ R_i - \left(i - \frac{1}{N} \right) \right\}$$

level of significance, α will be mentioned.

N = total number of random nos.

i	1	2	3	4	5
R_i					

← substitute values.

3) calculate:

$D = \max\{D^+, D^-\}$ / $D = \{\max D^+, \max D^-\}$

D^+					
D^-					

} upon calculating.

4) $D < D_\alpha \Rightarrow H_0$ accepted

AUTOCORRELATION TEST

M = largest integer such that $i + (M+1)m \leq N$

$H_0 : \rho_{im} = 0$, if nos are independent
$H_1 : \rho_{im} \neq 0$ if nos are dependent

$$\hat{\rho}_{im} = \frac{1}{M+1} \left[\Sigma R_{i+km} R_{i+(k+1)m} \right] \text{ or } \left[\sum_{k=0}^{M} R_{i+km} \cdot R_{i(k+1)m} \right] - 0.25$$

$$\hat{\sigma}_\rho = \sqrt{\frac{13M+7}{12(M+1)}} \quad ; \quad Z_0 = \frac{\hat{\rho}_{im}}{\hat{\sigma}_{\hat{\rho}_{im}}}$$

$Z_0 < z_{crit}$ then accept H_0