NON-PARAMETRIC INFERENCE

1. A manufacturer of electric bulbs claims that he has developed a new production process which will increase the average efficiency (in suitable units) from the present value of 9.03. The results obtained from an experiment with 15 bulbs from the new process are given as follows :

9.29	10.15	8.69
11.25	11.47	9.76
12.05	12.38	9.08
10.25	8.93	9.02
10.87	10.00	11.56

   Do we have reasons to believe that the efficiency has increased ?

2. 20 ear-head measurements of a variety of wheat are given as follows :

9.3	8.8	10.7	11.5
8.2	9.7	10.3	8.6
11.3	10.7	11.2	9.0
9.8	9.3	9.9	10.3
10.0	10.1	9.6	10.4

   Test at 5% level of significance whether the population median length of ear-head is 9.9 cm. by using Wilcoxon signed-rank test.

3. The following are the marks secured by two batches of salesmen in the final test taken after completion of training. Use an appropriate non-parametric test with $\alpha = 0.02$ for the null hypothesis that the samples are drawn from identical distributions against the alternative that the distributions differ in location only.

   Batch A : 26, 27, 31, 26, 19, 21, 20, 25, 30;

   Batch B : 23, 28, 26, 24, 22, 19.

4. Given below are the marks obtained by a group of 20 students in a subject in a college test and in the subsequent public examination. Test at 1% level whether the group has improved its mean performance from the college test to the public examination, by using

   (i) the sign test

   (ii) the Wilcoxon signed-rank test

Serial No.	Marks Obtained in	
	College Test	Public Examination
1	183	133
2	175	193
3	134	170
4	170	164
5	183	199
6	167	160
7	120	168
8	175	158
9	126	162
10	187	176
11	123	126
12	121	141
13	175	103
14	133	126
15	144	146
16	109	155
17	165	162
18	144	161
19	164	182
20	125	119

5. Scores on a clerical aptitude test administered to a batch of 6 Secretariat and 7 Directorate clerks are given below. Test whether the two groups of clerks have the same score distribution in the population.

Scores of Secretariat clerks	40	35	52	60	46	55	
Scores of Directorate clerks	47	56	42	57	50	57	62

6. Consider two samples as follows :

   $\mathbf{X} = (1, 5, 7, 9, 15, 17, 21, 23)$

   $\mathbf{Y} = (2, 6, 10, 12, 18, 20, 26, 28, 32)$.

   Test whether they have homogenous population distribution.