

## Tutorial 9

### Qn 1

Find a) the mean and b) the variance of the  $T$  statistics in the signed rank test.

### Qn 2

What are the underlying assumption(s) when we use

- a) Z test
- b) t test
- c) testing of equality of means of two normal populations with known variance
- d) testing of equality of means of two normal populations with unknown variance
- e) paired t test
- f) signed test
- g) signed rank test
- h) u test

### Qn 3

A question of medical importance is whether jogging leads to a reduction in one's pulse rate. To test this hypothesis, 8 non-jogging volunteers agreed to begin a 1 month jogging program. After the month their pulse rates were determined and compared with their earlier values. If the data are as follows, can we conclude that jogging can reduce the pulse rates at level of significance 0.05?

Subject	1	2	3	4	5	6	7	8
Pulse Rate before	74	86	98	102	78	84	79	70
Pulse Rate After	70	85	90	110	71	80	69	74

Assume that both the “pulse rate before” and “pulse rate after” are normally distributed and the two distributions are independent of each other.

### Qn 4

A new medicine against hypertension was tested on 18 patients. After 40 days of treatment, the following changes of the diastolic blood pressure were observed:

-5   -1   +2   +8   -25   +1   +5   -12   -16  
-9   -8   -18   -5   -22   +4   -21   -15   -11

- a) Use the sign test to determine if the medicine has an effect on blood pressure by computing the p-value. Will you conclude that the medicine has an effect on the blood pressure at level of significance 0.05?
- b) Repeat a) using the normal approximation.
- c) Repeat a) using the signed rank test. Use the normal approximation.

Qn 5

The outcome of an experiment is as follows:

-3   -6   5   4   -2   -1

- a) Test the hypothesis that the median is -4.5 using the sign test. The level of significance is 0.05.
- b) Repeat a) using the normal approximation.
- c) Repeat a) using the signed rank test. Use the normal approximation.