Probability and Statistics
Test Set 11

1. An electronics manufacturing company produces ICs which have lifetimes normally distributed with mean μ (in days) and variance 900 days. Find the rejection region for testing H_0: $\mu = 1000$ against H_1: $\mu > 1000$ at 1% level based on a sample of size n. Determine the power of this test at $\mu = 1060$ if $n = 25$.

2. An automobile manufacturer claims that the average mileage of its new two wheeler will be at least 40 km. To verify this claim 15 test runs were conducted independently under identical conditions and the mileages recorded (in km) as 39.1, 40.2, 38.8, 40.5, 42, 45.8, 39, 41, 46.8, 43.2, 43, 38.5, 42.1, 44 and 36. Test the claim of the manufacturer at $\alpha = 0.05$.

3. The average height of girls in the first year class of IIT Kharagpur has been 162.5 cm with a standard deviation 6.9 cm. Is there a reason to believe that there has been an increase in the average height if a random sample of 50 girls in the present first year batch has an average height of 165.2 cm? Take $\alpha = 0.01$.

4. The life of certain electrical equipment is normally distributed. A random sample of lives of twelve such equipments has a standard deviation of 1.3 years. Test the hypothesis that the standard deviation is more than 1.2 years at 10% level of significance.

5. A fire safety training program is claimed to be effective in reducing the loss of lives due to fire accidents. The following data are collected concerning the monthly loss of lives due to fire accidents in 6 suburban areas of a big city both before and after the fire safety program is conducted.

Suburb Area	1	2	3	4	5	6
Before	15	30	20	36	27	25
After	12	26	17	36	28	26

   Test the hypothesis if the claim is supported by the observed data at $\alpha = 0.05$.

6. Let μ_1 and μ_2 denote the mean yields by using fertilizer 1 and 2 respectively. On the basis of random samples of size 10 from each fertilizer, the following data were recorded: $\bar{X} = 90.13, \bar{Y} = 92.70, s_1^2 = 4.02, s_2^2 = 3.98$. Test the hypothesis H_0: $\mu_1 = \mu_2$ against H_1: $\mu_1 \neq \mu_2$. at 1% and 5% levels of significance.

7. A random sample of 280 families with 4 children showed the following number of male and female children as in the given table. Do the data justify the claim that the probabilities of birth for male and female children?

No. of Boys(B) & Girls (G)	4 B, 0 G	3 B, 1 G	2 B, 2 G	1 B, 3 G	0 B, 4 G
No. of families	17	69	102	74	18

8. When a new TV serial is launched, the producer wants to get a feedback from the viewers. Random samples of 250, 200 and 350 consumers from three cities are selected and the following data is obtained from them.

	Never heard of the serial	Heard about the serial but did not watch	saw it at least once	Total
City 1	51	70	129	250
City 2	60	71	69	200
City 3	69	93	188	350
Total	180	234	386	800

Can we claim on the basis of the observed data that the viewers' preferences differ in the three cities? (Take $\alpha = 0.1, 0.05$.)

9. In a random sample of 200 families watching television in Bombay at any given time, it was found that 45 were watching Network A. At the same time, in a random sample of 110 families watching television in New Delhi, it was found that 32 were watching Network A. Test the hypothesis that Network A is equally popular in both states (at this time) at 1% level of significance.