Probability and Statistics
Assignment No. 10

1. An electrical firm manufactures batteries which have lifetimes normally distributed with mean μ and standard deviation 40 hours. What is the rejection region for H_0: $\mu = 800$ against H_1: $\mu > 800$ at 5% level based on a sample of size n. Find the power of this test at $\mu = 820$ if n = 30.

2. The manufacturer of a new fiber glass tire claims that its average life will be at least 40,000 miles. To verify this claim a sample of 12 tires is tested with their lifetimes (in 1000 miles) as 36.1, 40.2, 33.8, 38.5, 42, 35.8, 37, 41, 36.8, 37.2, 33 and 36. Test the manufacturer's claim at $\alpha = 0.05$.

3. The average height of girls in the first year class of IIT Kharagpur has been 162.5 cms with a standard deviation 6.9 cms. 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 cms? Take $\alpha = 0.01$.

4. The life of a certain kind of car battery is normally distributed. If a random sample of 10 of these batteries has a standard deviation of 1.2 years, do you think that $\sigma^2 > 0.81$? Use 10% level of significance.

5. It is claimed that an industrial safety program is effective in reducing the loss of working hours due to factory accidents. The following data are collected concerning the weekly loss of working hours due to accidents in 6 plants both before and after the safety program is initiated.

Plant	1	2	3	4	5	6
Before	12	29	16	37	28	15
After	10	28	17	35	25	16

Test the hypothesis if the data support the claim. (Take $\alpha = 0.05$.)

6. Two catalysts are being analyzed to determine how they affect the mean yield of a chemical process. Let μ_1 and μ_2 denote the mean yields by using catalyst 1 and 2 respectively. On the basis of random samples of size 8 from each process, the following data were recorded: $\overline{X} = 91.73$, $\overline{Y} = 93.75$, $s_1^2 = 3.89$, $s_2^2 = 4.02$. At 5% level of significance test the hypothesis H_0: $\mu_1 = \mu_2$ vs. H_1: $\mu_1 \neq \mu_2$.

7. A survey of 320 families with 5 children revealed the distribution shown in the given table. Is the result consistent with the hypothesis that male and female births are equally likely?

No. of Boys(B) & Girls (G)	5 B, 0 G	4 B, 1 G	3 B, 2 G	2 B, 3 G	1 B, 4 G	0 B, 5 G
No. of families	18	56	110	88	40	8

8. When a new product is introduced in a market, it is important for the manufacturer to evaluate its performance during the critical months after its distribution. A study of market penetration involves sampling consumers and assessing their exposure to the product. Suppose that the marketing division of a company selects random samples of 200, 150 and 300 consumers from three cities and obtains the following data from them:

	Never heard of the product	Heard about the product but did not buy	Bought it at least once	Total
City 1	36	55	109	200
City 2	45	56	49	150
City 3	54	78	168	300
Total	135	189	326	650

Do these data indicate that the extent of market penetration differs 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.