Probability and Statistics
Assignment No. 8

1. Find a **90%** confidence interval for the mean of a normal distribution with $\sigma = 3$, given the sample $(3.3, -0.3, -0.6, -0.9)$. What would be the confidence interval if σ were unknown?

2. If **31** measurements of boiling point of sulphur have a standard deviation 0.83^0 Celsius, construct a **98%** confidence interval for the true standard deviation of such measurements.

3. In pouring glass for use in automobile windshields uniformity of thickness is desirable to prevent distortion. If a random sample of 100 wind shields yields a sample standard deviation of 0.01 inch, construct a 95% confidence interval on the standard deviation in thickness.

4. Five pairs of tests are conducted to compare two methods of making rope. Each sample batch contains enough hemp to make two ropes. The tensile strength measurements are:

Tests	1	2	3	4	5
Method 1	14	12	18	16	15
Method 2	16	15	17	16	14

   Find a 95% confidence interval for the mean difference in tensile strengths between ropes made by two methods.

5. Independent random samples of sizes 36 and 49 are taken from two normal populations having known standard deviations of 1.2 and 1.8 respectively. Based on these samples find a 90% confidence interval for the difference in the means of two populations.

6. 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.

7. 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 $\alpha = 0.05$.

8. 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 $\alpha = 0.01$.

9. 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.

10. 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 $\alpha = 0.05$.)

11. 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: $\mu_1 \neq \mu_2$.

12. 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.