1. It has previously been recorded that the average depth of ocean at a particular region is 67.4 fathoms. Is there reason to believe this at 0.01 level of significance if the readings at 40 random locations in that particular region showed a mean of 69.3 with S.D. of 5.4 fathoms?

2. A random sample of 40 'geyers' produced by a company A have a mean life time of 647 hrs of continuous use with S.D. of 27 hrs; while a sample of 40 produces by another company B have a mean life time of 638 hrs with S.D. 31 hrs. Does this substantiate the claim of company A that their 'geyers' are superior to those produced by company B at 0.05 level of significance.

3. Test at 0.05 level of significance a manufacturer's claim that the mean tensile strength (mts) of htread A exceeds the mts of thread B by at least 12 kgs. Is 50 pieces of each type of thread are tested under similar conditions yielding the following data:

| | Sample size | mts (KGs) | S.D. (KGs) |
|---|---|---|---|
| Type A | 50 | 86.7 | 6.28 |
| Type B | 50 | 77.8 | 5.61 |

4. To test the claim that men are taller than women, a survey was conducted resulting in the following data:

| Gender | Sample size | mean height (cm) | S.D. (cm) |
|---|---|---|---|
| Men | 1600 | 172 | 6.3 |
| Women | 6400 | 172 | 6.4 |

Is the claim tenable at 0.01 level of significance.

5. In 1950 in India the mean life expectancy was 50 years. If the life expectancy was 15 years. If the life expectancies from a random sample of 11 persons are 58.2, 56.6, 54.2, 50.4, 44.2, 61.9, 57.5, 53.4, 49.7, 55.4, 57.0,, does it confirm the expected view.

6. A student answers by guess 32 questions correctly in an examination with 50 true and false questions. Are the results significant at 0.05 level of significance.          Ans: Reject Ho.

7. A hospital claims that at least 40 % of the patients admitted are for 'emergency' ward. Is there a reason to believe this claim if the records shows that only 49 of 150 patients are for 'emergency' ward. Use 0.01 level of significance. Ans: Accept Ho.

8. In a survey of A.C. machines produced by company A it was found that 19 machines were defective in a random sample of 200 while for company B 5 were defective out of 100. At 0.05 level of significance, is there reason to believe that (a) there is significant difference in performance of A.C. machines between the two companies A and B (b) products of B are superior to products of A. Ans: (a) Accept Ho (b) Accept Ho.

9. If a can containing 500 dryfruits is selected at random from each of three companies A, B, C of mixed dry fruits and there are 345, 313 and 359 cashew nuts respectively in each of the cans, can we conclude at 0.01 level of significance that the mixed dry fruits of three companies contain equal proportions of cashew nuts. Ans: Reject Ho.

10. Test for goodness of fit of a Poisson distribution at 0.01 level of significance to the following observed data of emails received:

| No of emails | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Observed Frequency | 3 | 15 | 47 | 76 | 68 | 74 | 46 | 39 | 15 | 9 | 5 | 2 | 0 | 1 |

**Part B:**

1. A firm manufactures two types of products A and B and sells them at a profit of Rs. 2 on type A and Rs. 3 on type of B. Each products is processed on two machines $M_1$ and $M_2$ . Type A requires 1 minute of processing time on $M_1$ and 2 minutes on $M_2$. Type B requires 1 minute on $M_1$ and I minute on $M_2$. Machine $M_1$ is available for not more than hours 40 minutes while machine $M_2$ is available for 10 hours during any working day. Formulate the problem as a LPP so as to maximize the profit.

2. A firm produces three products. These products are processed on three different machines. The time required to manufacture one unit of each of the three products and the daily capacity of the three machines are given in the table below:

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| Machine | Time per unit (minutes) | | | Machine capacity (Minutes/day) |
|---------|-----------|-----------|-----------|----------|
|         | Product 1 | Product 2 | Product 3 |          |
| $M_1$   | 2 | 3 | 2 | 440 |
| $M_2$   | 4 | - | 3 | 470 |
| $M_3$   | 2 | 5 | - | 430 |

It is required to determine the number of units to be manufactured for each product daily. The profit per unit for product 1, 2, and 3 is Rs. 4, Rs. 3 and Rs. 6 respectively. It is assumed that all the amounts produced are consumed in the market. Formulate the mathematical model for problem.

3. Apply graphical method to solve the LPP:
Maximize $Z = 4x_1 + 3x_2$
s.t. $x_1 - x_2 \leq -1$, $-x_1 + x_2 \leq 0$, $x_1, x_2 \geq 0$.

4. Apply graphical method to solve the LPP:
Minimize $Z = 5x_1 + 7x_2$
s.t. $x_1 + 2x_2 \leq 20$, $3x_1 + x_2 \geq 15$, $4x_1 + 3x_2 \leq 60$, $x_1, x_2 \geq 0$.

5. Solve the following LPP by simplex method
Minimize $Z = x_2 - 3x_3 + 2x_5$
St $3x_2 - x_3 + 2x_5 \leq 7$, $-2x_2 + 4x_3 \leq 12$, $-4x_2 + 3x_3 + 8x_5 \leq 10$, $x_2, x_3, x_5 \geq 0$.

6. Solve the following LPP by simplex method
Maximize $Z = 15x_1 + 6x_2 + 9x_3 + 2x_4$ .
S.t $2x_1 + x_2 + 5x_3 + 6x_4 \leq 20$, $3x_1 + x_2 + 3x_3 + 25x_4 \leq 24$, $7x_1 + x_4 \leq 70$, $x_1, x_2, x_3, x_4 \geq 0$

9. Solve the following problem by simplex method (Big-M method)
Maximize $Z = 6x_1 + 4x_2$
S.t $2x_1 + 3x_2 \leq 30$, $3x_1 + 2x_2 \leq 24$, $x_1 + x_2 \geq 10$ $x_1, x_2 \geq 0$.

10. . Solve the following problem by simplex method (Big-M method)
Maximize $Z = 8x_2$
S.t $x_1 - x_2 \geq 0$, $2x_1 + 3x_2 \leq -6$, $x_1 + x_2 \geq 10$ $x_1, x_2 \geq 0$.

11 Use two-phase simplex method to solve
Maximize $Z = 5x_1 + 3x_2$
St $2x_1 + x_2 \leq 1$, $x_1 + 4x_2 \leq 6$, $x_1, x_2 \geq 0$.

12. Use two-phase simplex method to solve
Minimize $Z = 2x_1 - x_2$
St $x_1 + x_2 \geq 1$, $x_1 + x_2 \leq 4$, $x_1, x_2 \geq 0$.