Practice Sheet (Graphical Method)

Problem 1: (Production Planning and Marketing)
A company produces two types of hats: type 1 and type 2. Labour time required to manufacture type 1 hat is two times more than type 2 hat. If all hats are of the second type, only the company can produce a total of 500 hats a day. The market limits daily sales of first and second type to 150 and 250 hats. The profits per hat are \$8 for type 1 and \$5 for type 2. Formulate the problem as a linear programming model in order to determine the number of hats to be produced of each type so as to maximize the profit. Also, determine the optimal solution.

Problem 2: (Linear Programming for a Chemical Problem)
A person requires 10, 12, and 12 units of chemicals A, B, and C, respectively, for his garden. The liquid product contains 5 units, 2 units, and 1 unit of A, B, and C, respectively, per jar. The dry product contains 1 unit, 2 units, and 4 units of A, B, and C, respectively, per jar. If the liquid product sells for \$3 per jar, and dry product sells for \$2 per jar, how many of each should be purchased to minimize the cost and meet the requirements. Solve the problem using the graphical method.

Problem 3: (Manufacturing Allocation Problem)
A plant manufactures washing machines and dryers. The major manufacturing departments are stamping department, motor transmission department, and assemble department. The first two departments produce parts for both products, while the assembly lines are different for the two products. The monthly department capacities are:

- Stamping department: 1000 washers or 1000 dryers or any other linear combination.
- Motor transmission department: 1600 washers or 7000 dryers or any other linear combination.
- Washer assembly line: 9000 washers only.
- Dryer assembly line: 5000 dryers only.

Profit per unit of washer and dryer are \$270 and \$300 respectively. Formulate and obtain the solution.

Problem 4: (Production Planning and Marketing - Bottling Soft Drinks)
A soft drink plant has two bottling machines, A and B. Machine A is assigned to produce 8-ounce bottles, and machine B is assigned to produce 16-ounce bottles. The production rates for the machines are as follows:

Machine	**8-ounce bottle**	**16-ounce bottle**
A	100 bottles/minute	40 bottles/minute
B	60 bottles/minute	75 bottles/minute

Each machine can operate for 8 hours per day, 5 days a week. The profit per 8-ounce bottle is 15 paise, while the profit per 16-ounce bottle is 25 paise. Weekly production is limited by the following constraints:

- The total production of all bottles cannot exceed 300,000 ounces.
- The market can absorb a maximum of 25,000 8-ounce bottles and 7,000 16-ounce bottles per week.

Formulate this problem as a linear programming model to determine the number of 8-ounce and 16-ounce bottles to produce weekly in order to maximize profit. Use the graphical method.

Problem 5: (Production Planning and Marketing - Leather Belts)
A company produces two types of leather belts: type A of superior quality and type B of lower quality. The profits on the two types of belts are 40 paise per belt for type A and 30 paise per belt for type B. The following constraints apply to the production:

- Each belt of type A requires twice as much leather as a belt of type B.
- If all belts are of type B, the company can produce a maximum of 1,000 belts per day.
- The total supply of leather is sufficient for a maximum of 800 belts (regardless of type) per day.
- Belt A requires fancy buckles, with only 400 fancy buckles available daily.
- Belt B requires regular buckles, with a maximum of 700 buckles available per day.

Formulate this problem as a linear programming model to determine how many belts of each type the company should produce daily in order to maximize overall profit. Solve the problem using the graphical method.