

ME421: IEOR

Assignment 01: Linear Programming Model

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1. A manufacturing company is engaged in producing three types of products: A, B, and C. The production department produces, each day, components sufficient to make 50 units of A, 25 units of B and 30 units of C. The management is confronted with the problem of optimizing the daily production of the products in the assembly department, where only 100 man-hours are available daily for assembly the products. The following additional information is available:

Type of product	Profit contribution per unit of product (INR)	Assembly time per product (hrs)
A	12	0.8
B	20	1.7
C	45	2.5

The company has a daily order commitment for 20 units of product A, and a total of 15 units of products B and C. Formulate this problem as an LP model so as to maximize the total profit.

2. A company has two plants, each of which produces and supplies two products: A and B. Each plant can work up to 16 hours a day. In plant 1, it takes three hours to prepare and pack 1,000 gallons of A and one hour to prepare and pack one quintal (equivalent to 100 Kg) of B. In plant 2, it takes two hours to prepare and pack 1,000 gallon of A and 1.5 hours to prepare and pack a quintal of B. In plant 1, it costs INR 15,000 to prepare and pack 1,000 gallons of A and INR 28,000 to prepare and pack a quintal of B, whereas in plant 2 these costs are INR 18,000 and INR 26,000, respectively. The company is obliged to produce daily at least 10 thousand of gallons of A and 8 quintals of B. Formulate this problem as an LP model to find out as to how the company should organize its production so that required amount of the two products to be obtained at the minimum cost.
3. An electronic company is engaged in the production of two components C_1 and C_2 that are used in radio sets. Each unit of C_1 costs the company INR 5 in wages and INR 5 in material, while each of C_2 costs the company INR 25 in wages and INR 15 in material. The company sells both products on one-period credit terms, but the company's labor and material expenses must be paid in cash. The selling price of C_1 is INR 30 per unit and of C_2 it is INR 70 per unit. Because of the company's strong monopoly in these components, it is assumed that the company can sell, at the prevailing prices, as many units as it produces. The company's production capacity is, however, limited by two considerations. First, at

the beginning of period 1, the company has an initial balance of INR 4,000 (cash plus bank credit plus collections from past credit sales). Second, the company has available in each period 2,000 hours of machine time and 1,400 hours of assembly time. The production of each C_1 requires 3 hours of machine time and 2 hours of assembly time, whereas the production of each C_2 requires 2 hours of machine time and 3 hours of assembly time. Formulate this problem as an LP model so as to maximize the total profit to the company.

4. A trucking firm has received an order to move 3,000 tonnes of industrial material to a destination 1,000 km away. The firm has available, at the moment, a fleet of 150 class-A 15-tonne trailer trucks and another fleet of 100 class-B 10 tonnes trailer trucks. The operating costs of these trucks are INR 3 and INR 4 per tonne per km, respectively. Based on the past experience, the firm has a policy of retaining at least one class-A truck with every two class-B trucks in reserve. It is desired to know the how many of these two classes of vehicle should be dispatched to move the material at minimal operating costs. Formulate this problem as an LP model.