

S H E E T 1

Linear Programming

**Arab Academy for Science and Technology
College of Engineering and Technology
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IM423 – OPERATIONS RESEARCH

1. The Whitt Window Company is a company with only three employees which makes two different kinds of hand- crafted windows: a wood- framed and an aluminium-framed window. They earn \$60 profit for each wood- framed window and \$30 profit for each aluminium- framed window. Doug makes the wood frames, and can make 6 per day. Linda makes the aluminium frames, and can make 4 per day. Bob forms and cut glass, and can make 48 square feet of glass per day. Each wood- framed window uses 6 square feet of glass and each aluminium-framed window uses 8 square feet of glass. The company wishes to determine how many windows of each type to produce per day to maximize total profit. Formulate the linear programming model for this problem.
2. The Apex Television Company has to decide on the number of 27-and 20-inch sets to be produced at one of its factories. Market research indicates that at most 40 of 27 inch sets and 10 of the 20-inch sets can be sold per month. The maximum number of work hours available is 500 per month. A 27-inch set requires 20 work-hours and a 20-inch set requires 10 work-hours. Each 27inch set sold produces a profit of \$120 and each 20-inchset produces a profit of \$80. A wholesaler has agreed to purchase all television sets produced if the numbers do not exceed the maxima indicated by the market research. Formulate the linear programming model for this problem.
3. The Omega Manufacturing company has discontinued the production of a certain unprofitable product line. This act created considerable excess production capacity to one or more of three products; call them product 1, 2, and 3. The available capacity on the machines that might limit output is summarized in the following table:

Machine Type	Available time (machine hours per week)
Milling machine	500
Lathe	350
grinder	150

The number of machine hours required for each unit of the respective products is

Productivity coefficient (in machine hours per unit)			
Machine type	Product 1	Product 2	Product 3
Milling machine	9	3	5
Lathe	5	4	0
Grinder	3	0	2

The sales department indicates that sales potential for products 1 and 2 exceeds the maximum production rate and that the sales potential for product 3 is 20 units per week. The unit profit would be \$50, \$20, and\$25 respectively on products 1, 2 and 3. The objective is to determine how much of each product Omega should produce to maximize profit. Formulate the linear programming model for this problem.

4. The world light company produces two light fixtures (products 1 and 2) that require both metal frame parts and electrical components. Management wants to determine how many units of each product to produce so as to maximize profit. For each unit of product1, 1 unit of frame parts and 2 units of electrical components are required. For each unit of products 2, 3 units of frame parts and 2 units of electrical components are required. The company has 200 units of frames parts and 300 units of electrical components. Each unit of products 1 gives a profit of \$1, and each unit of products 2, up to 60 units, gives a profit of \$2. Any excess over 60 units of products 2 brings no profit, so such an excess has been ruled out. Formulate the linear programming model for this problem.
5. The primo Insurance Company is introducing two new product lines: special risk insurance and mortgages. The expected profit is \$5 per unit on special risk insurance and \$2 per unit on mortgages. Management wishes to establish sales quotas for the new products lines to maximize total expected profit. The work requirements are as follows:

Department	Work-hours per Unit		Work-hours Available
	Special risk	Mortgage	
Underwriting	3	2	2400
Administration	0	1	800
Claims	2	0	1200

Formulate the linear programming model for this problem.

6. A stereo mail order centre has 8,000 cubic feet available for storage of its private label loudspeakers. The ZAR-3 speakers cost \$295 each and require 4 cubic feet of space; the ZAR-2ax speakers cost \$110 each and require 3 cubic feet of space; and the ZAR-4 model costs \$58 and requires 1 cubic foot of space. The demand for the ZAR-3 is at most 20 units per month. The wholesaler has \$100,000 to spend on loudspeakers this month. Each ZAR-3 contributes \$105, each ZAR-2ax contributes \$50, and each ZAR-4 contributes \$28. The objective is to maximize total contribution. Formulate the linear programming model for this problem.