

620-261 Introduction to Operations Research

TUTORIAL 7

1. A sports shoe manufacturer makes four types of shoe; a running shoe, a cross-training shoe, a basketball shoe and a terrain-running shoe.

To make a pair of each type of shoe, a certain amount of time is required on a cutting machine (CM), a sewing machine (SM) and a finishing machine (FM). The company leases the required machines from a hire company, which can make 160 person hours of cutting machine time, 178 person hours of sewing machine time and 144 person hours of finishing machine time available each day.

The profit on a pair of each type of shoe and the amount of manufacturing time required on the different machines to make a pair of each type of shoe are given in the table below.

	Profit (\$)	CM (hrs)	SM (hrs)	FM (hrs)
Running Shoe	120	0.5	1.0	1.0
Cross-Training Shoe	80	0.5	0.5	0.5
Basketball Shoe	160	1.0	1.0	1.0
Terrain-Running Shoe	70	0.5	1.0	0.5

Formulate, a linear program whose optimal solution stipulates how many pairs of each type of shoe should be made each day in order to maximise the company's profit.

2. Now assume that a rival company wants to get into the shoe making business and decides to make an offer to the hire company for the cutting machine, the sewing machine and the finishing machine time with the intention that the hire company will deal with the rival, rather than the original, company.

Formulate a linear program that can be used to decide how much the rival company should offer to pay for an hours work on each of the machines, in order to minimise its outlay but still convince the hire company to deal with it.

3. Explain how the linear program that you have produced in question 2 above is the dual of that in question 1.