Homework #8

This is an individual assignment. All work that you submit for credit must be your own.

1. Better Products, Inc. manufactures three products on two machines. Every product must be processed on both machines. In a typical week, 40 hours are available on each machine. The profit contribution and production time in hours per unit are given in the table below

	Product 1	Product 2	Product 3
Profit/unit	$30	$50	$20
Machine 1 hours/unit	0.50	2.00	0.75
Machine 2 hours/unit	1.00	1.00	0.50

   Two operators are required to run machine 1 which means 2 hours of labor are required for each hour of production time on machine 1. However, only one operator is required to run machine 2. A maximum of 100 labor hours are available each week. Product 1 cannot account for more than 50% of the total units produced, and product 3 must account for at least 20% of the total units produced.
   a. Construct a linear optimization model for this problem and use it to find an optimal solution.
   b. How does the optimal solution change as the total labor hours increases from 100 to 140 hours?
   c. If the labor capacity can be increased to 120 hours would you use them? If so, what would be the new optimal solution using these additional hours?

2. Frandec Company manufactures material handling equipment used in warehouses and distribution centers. One product, called a Liftmaster, is assembled from four components: a frame, a motor, two supports, and a metal strap. Frandec's production schedule calls for 5,000 Liftmasters to be made next month. Frandec purchases the motors from an outside supplier, but the frames, supports, and straps may be either manufactured by Frandec or purchased from an outside supplier. Manufacturing and purchase costs per unit are shown in the table below.

Component	Manufacturing Cost	Purchase Cost
Frame	$38.00	$51.00
Support	$11.50	$15.00
Strap	$6.50	$7.50

   Three departments are involved in the production of these components.

The time (minutes per unit) required to process each component in each department and the available capacity (in hours) for the three departments are provided in the table below.

Component	Department (mins/unit)		
	Cutting	Milling	Shaping
Frame	3.5	2.2	3.1
Support	1.3	1.7	2.6
Strap	0.8	--	1.7
Capacity (hours)	350	420	680

a. Formulate this problem as a linear program and use it to find an optimal solution.
b. How much would Frandec be willing to pay for an additional hour of time in each of the three departments?
c. Frandec would like to negotiate a lower purchase price for the frames. The purchasing manager thinks it only makes sense to purchase frames if the price is less than Frandec's internal manufacturing cost ($38). Provide appropriate analysis to support Frandec's negotiation for a lower frame purchase price.