

Examples Chapter 5

5.8. Consider the following production plan:

Month	Beginning inventory	Demand	Required production	Number of workers	Actual production
January	200	500	300	15	660
February	360	600	?	15	660
March	?	650	?	15	660

- How many units are produced by each worker?
- How many units must be produced in February if no shortages are allowed?
- What is the beginning inventory for March for the given plan?
- What is the total inventory cost incurred for this plan if it costs \$12 per year to hold one unit in inventory?
- What would you call this plan?
- Is it optimal? Explain.

5.10. X-Print Manufacturing makes laser printers. One plant assembles the PL-4000 model. Standards indicate that one worker can assemble five printers per day. This model costs about \$350 to make, and the company figures it costs \$5 to hold one printer in inventory for one month. Workers earn \$1500 per month and can be hired for \$500 each; firing a worker costs \$750. Currently, there are 12 workers in the assembly department. If a printer is backordered, the cost is \$35 per unit per month.

Month	July	August	September	October	November	December	Total
Working Days	21	22	21	23	19	20	126
Demand	1020	950	800	1000	1250	650	5670

- Develop a zero inventory plan for this problem.
- Develop a constant work force plan when no backorders are allowed.
- Because this plan does not consider backorders, your boss asks you to develop a constant work-force plan that allows backorders. Which is the better plan?
- Due to a long-range capacity plan, the assembly department will be relocated, which requires the department to shut down. There are two possible times for this to happen. One is to shut down for four days in October, and the other will necessitate an eight-day shutdown in December. Which plan would you recommend?

5.16. Consider X-Print Manufacturing (Problem 5.10).

- (a) Give the constraints for the first month of a linear programming formulation for this problem. Assume backorders are allowed and, in any month no more than a 25 percent change in work force is allowed.
- (b) Determine an optimal plan for X-Print. How does it compare with the spreadsheet plan?
- (c) Due to stiff competition in the laser printer market, X-Print wants to reexamine its backorder policy. What backorder cost would make the no-backorder case better than the backorder case?
- (d) Does the linear programming formulation answer the question of when to relocate the assembly department? If so, how? If not, can it be modified to do so?

5.21. Generic, Inc., produces a variety of generic prescription drugs, which are sold to chain pharmacies. All drugs are in tablet form and are made on the same production line. Currently, the plant is operating two shifts per day, five days per week, and demand for the next four months is 420, 350, 410, and 315 million tablets. Each shift can produce 200 million tablets per month at a cost of \$0.50 per tablet. Overtime can be used to produce tablets at a 65 percent premium. Only two hours per day of overtime can be used, because of maintenance that must be performed on the production equipment. Current inventory is two million tablets, and Generic wants three million in inventory at the end of month 4. It costs \$15,000 to hold one million tablets in inventory for one month. Because the pharmacies are ordering for their distribution centers, most orders can be backordered. Contracts specify a 30 percent penalty for late deliveries. Develop an optimal aggregate production plan for the next four months.

5.22. Suppose Generic (Problem 5.21) can modify their production line to get a 15 percent increase in capacity. How much could they afford to pay for the upgrade and recover the cost in one year? List all assumptions you make to answer the question.

5.29. Hardbody manufactures two fitness machines, the Flex (F) and the Crunch (C). Estimated demand for the Flex is 1500, 1200, and 1600 units, and for the Crunch it is 1000, 1200, and 900 units for the next three months. The current inventory is 550 units for the Flex and 250 units for the Crunch. Two resources, worker-hours and machine-hours, are used to manufacture both fitness machines. The additional information for available capacity of resources per unit, holding cost per unit, unit cost, and resource requirement per unit are as follows :

Month	Capacity (hours)		Cost (\$)			
	Machine	Worker	Holding		Process	
			F	C	F	C
1	1250	19000	22	31	650	930
2	1270	19000	22	31	670	930
3	1350	19500	23	32	680	950
		Machine-hours required			0.45	0.75
		Worker-hours required			6	12

Develop a model and solution for the next three months' production at Hardbody.

5.30. Suppose Hardbody can use up to 20 percent of capacity on overtime in any month at a 60 percent higher cost. Give a modified model and solution.