Case Summary:

- A new computer model has been released.
- Need to plan the production of two products which are
  - computer itself
  - its monitor
- A monitor is both an intermediate product for the computer and a final product.
- Both products are produced starting from initial basic products and an intermediate product phase is passed until final products are obtained.
- Initial products are bought from other companies:
  - Hard drive,
  - RAM,
  - LCD screen
- Intermediate product computer cases can either be produced within the company or bought from outsiders.
- Assume that regardless of when the monitor and computer will be ready, the company will ship the products to the customers at the end of 5 days.

Table 1. The input products required to produce each product

Product	Input Product
Hard drive	-
RAM	-
Computer case	Hard drive, RAM
LCD screen	-
Monitor	LCD screen
Computer	Computer case, Monitor

Table 2. Initial inventory levels of products hard drive, RAM, computer case, LCD screen, and monitor

Product	Initial Inventory
Hard drive	700
RAM	750
Computer case	550
LCD screen	650
Monitor	500

Table 3. Ordering and production costs and lead times of products

Product	Ordering Cost($)/unit	Production Cost($)/ unit	Order Lead Time (days)	Production Lead Time (days)
Hard drive	5.2	-	1	-
RAM	3.6	-	2	-
Computer case	4.7	5.1	2	2
LCD screen	6.2	-	2	-
Monitor	-	4.3	-	4
Computer	-	3.5	-	3

Table 4. Ordering and production capacities of products

Product	Order Capacity	Production Capacity
Hard drive	250	-
RAM	220	-
Computer case	180	210
LCD screen	400	-
Monitor	-	375
Computer	-	275

Table 5. Inventory holding costs and capacities for products

Product	Inventory Holding Cost/unit	Inventory Capacity
Hard drive	0.09	450
RAM	0.11	320
Computer case	0.08	360
LCD screen	0.08	250
Monitor	0.12	450
Computer	0.07	470

A. Draw the network representation of the problem to formulate the following problems as a network flow problem.

B. Assume that customers have placed orders on monitor and computer, and they want to receive their shipments by the end of 5th day. The amounts they ordered for monitor and computer are 250 and 500 units, respectively. The company has negotiated profitable prices for both products and its main concern is to make the deliveries with minimum cost.

i. What should be the production plan of the company? What is the total cost?

ii. If the company could increase the order capacity of any of the products, should it consider this option?

C. Assume that the company is certain that it can sell as many products as it can produce and it assumes that both monitor and computer will have very close profit margins so that we do not need to explicitly consider the costs. What should be the production plan of the company? How many monitors and computers should be produced?

D. Assume that the company wants to make a full analysis considering all the costs of the production process and selling prices of products. Monitor is sold for a fixed unit price of 100, whereas the selling price of the computer differs for different production quantities. The selling price of the computer is 100 for production amounts lower than 500, 90 for amounts between 500-800 and 80 for amounts higher than 800 i.e all units discount. Assuming that the company can sell as many products as it produces, what should be the production plan of the company? What is the total profit?

E. Now, suppose that incremental cost discount policy is used. If a customer orders computers less than 200, the computers are sold for 120. If a customer order between 200 and 500, then the first 200 computers are sold for 120 and the rest is sold for 110. Similarly, if a customer orders more than 500, then each unit is sold for 100. Suppose that initial monitor inventory is now 550 and selling price is constant and 90 per unit. Assuming that the company can sell as many products as it produces, what should be the production plan of the company? What is the total profit?