

Solve the problem below and provide the results in the format of an engineering report and the source files of the simulation also work needs to be explained in clear manner and well organized as expected for a masters student

Software to be used : QM for windows

book of reverence: Render, B, Stair, R, Hanna, M, Quantitative Analysis for Management, 13th edition

A system for printer manufacturing consists of a number of factories, warehouses, distribution centers, and customers as shown in Figure 1.

Printers Type “Laser Jet Pro” are fabricated in two (2) factories located at different cities. The printers are then shipped to two (2) warehouses at which they then shipped to three (3) distribution centers. At the distribution centers, printers are subjected to a very strict quality inspection process. Any printers do not meet quality standards will be returned directly to the factories to be reworked (repaired). The printers passed the inspection test are transported to ten (6) customers to satisfy their needs. From historical data, the rate of rework is (2% of the printers inspected at distribution centers). The unit transportation cost between any two nodes in the network is estimated to be SR 5.

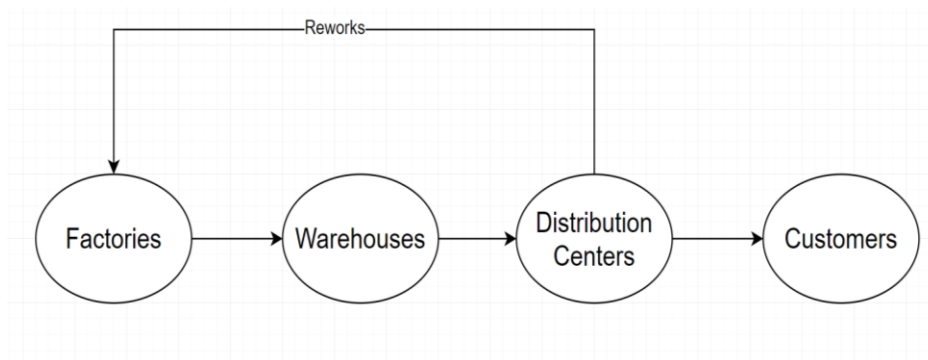


Figure 1: Printer manufacturing and distribution network

The two factories have production capacities and production cost listed in the following table.

Factory	F1	F2
Daily Production Capacity (printers)	950	800
Production cost(SR/printer)	100	95
Rework cost(SR/printer)	10	10

The warehouses have a limited space (volume shown in table below). Each printer has the following dimensions (50 cm length, 40 cm wide, and 20 cm height).

Warehouse	W1	W2
Volume (m ³)	400	350

Customer daily demands need to be satisfied without any shortage (table below).

Customers	C1	C2	C3	C4	C5	C6
Daily demand	120	180	144	150	175	200

- Develop a mathematical model (in general form) to help the company determine the number of printers to produce in each factory, flow between each two nodes, number of printers returned per day while minimizing the total cost including (production cost, rework cost, and transportation cost).
- Find the optimal solution using software
- Conduct sensitivity analysis to study the impact of rate of rework (1%, 2%, 5%, 10%, 15%, 20%) on the model performance and number of produced printers per day.
- **The manager of warehouse W1** wants to find a low cost inventory policy for printers. The manager identifies two types of variables, controllable and uncontrollable inputs. The controllable inputs are the order quantity and reorder points. The uncontrollable inputs are daily demand and variable lead time. Based on historical data, the demand data for the printers and lead times are shown in Tables below:

Daily Demand For printers	Frequency (Days)
0	10
1	20
2	40
3	60
4	40
5	30

Lead Time (Days)	Frequency (Orders)
1	10
2	25
3	15

The first policy that the manager wants to test is an order quantity of 20 printers with a reorder point of 5 printers. Conduct the simulation for a 20 day period? Use excel. The warehouse is open 200 days a year. Estimated ordering cost is SR30 per order. Holding cost is SR 22 per drill per year. Lost sales cost SR 25. Find total daily cost.

- **Re-simulate** using different values of an order quantity of (35 printers) and reorder point of (4 printers). Compare costs of the two policies. Based on the obtained cost which policy you would recommend.