

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

Pilani Campus

FIRST SEMESTER- 2022-2023

ANALYTICS FOR SUPPLY CHAIN

Comprehensive EXAM – CLOSED BOOK

Max. Marks: 35

Date: 10/03/23

Time: 1.5 Hrs.

Q.1 Assume Sony is to manufacture 27 PCs with three distinct components: C1, C2 and C3. Under the disaggregate option, Sony designs each component for each PC resulting into 81 components. Under common components option, Sony designs such that with three distinct C1, C2 and C3 can be combined to create 27 different PCs. Monthly demand of each of the 27 PCs is independent and normally distributed with a mean of 5000 and S.D of 3000. The replenishment lead time for each component is one month. Assume desired CSL of 95% for component inventory. Evaluate safety inventory requirements with and without use of common component community. ($Z @ 95\% = 1.64$) **(5 Marks)**

Q.2 Weekly demand for Nokia cell phones at a Best buy store is normally distributed with a mean of 300 per month and S.D. of 200 per month. The order placement and order receipt and update cost is Rs 4000 per order and inventory holding cost is 20 percent of each cell phone's cost. Cell phone costs varies from 20,000 to 50,000 per unit. Nokia takes two weeks to supply Best buy order. Best buy is targeting CSL of 95 % and has continuous monitoring policy. How much safety inventory should Best buy should carry? What should be its ROP? What is the average inventory in this case particular case? **(5 Marks)**

Q.3 Bangalore based retail company owns two outlets- one in an up market mall and other a discount store in Chennai. It has procured 2,000 quantities of a new toy at a unit cost of Rs 300 from China for the Christmas season. The retailer plans to sell the toy at Rs 500 at the discount store and at Rs 800 in the up market mall during the Christmas season. The retailer knows that at the discount retailer there is unlimited demand for this new toy but demand for new toy at the up market mall is likely to be normally distributed with a mean of 600 and S. D. of 200. As per customer policy, all the leftover toys at the end of Christmas season will be donated to charity.

a) Suppose company relied exclusively on discount market, what would be the company's expected profit? **(3 Marks)**

c) How many toys should the retailer reserve for the up market mall retail outlet if company decides to sell through both markets. **(5 Marks)**

Q.4. Mr. Hari Harsha, General Manager at Quicktronics, a contract manufacturer for consumer electronics was headed to the annual meeting. He had the demand forecast for the next 12 months and goal of the meeting was to set up sales and operations plan. Historically Mr. Hari had maintained a steady workforce of 667 teams in the plant and had built inventory in the first half of the year for use in the second half of the year. Mr. Hari walked into the meeting, he wondered whether the hiring and firing of workforce is better than inventory hold to meet demand in the second half of the year.

Quicktronics has set up a large assembly plant in Noida that focused on the assembly of smartphones. UP government is offering incentives to set up plant in Noida to diversify Noida into electronics manufacturing hub in India. Many components & supplies are also located close to Quicktronics and sent two small batches to the factory. Assembled phones were stored in a warehouse and from where they were shipped to the other parts of India and other Asian countries. The supply chain of Quicktronics has worked with marketing team and developed monthly demand forecast of the year of 2023 as shown in the table below:

Demand forecast for smartphones (units in thousands)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
s:												
Demand:	800	1000	1100	1100	1100	1200	1300	1400	1500	1700	1900	1900

Smartphone assembly line were handled by teams of 10 workers. Each team had the capacity to assemble 125 phones per hour. The capacity of the factory was determined by the number of teams deployed. Factory operates for 20 days a month, 8 hours a day. Assembly workers were paid Rs. 400/hour during regular time. They could be asked to work up to an additional 10 hours per month as overtime. Overtime rates is Rs. 600/hour. If Quicktronics choose to lay off workers, each lay off cost to the company is Rs. 80,000 and each hiring cost Rs. 40,000. It costs Rs. 5000 per smartphone to carry in the storeroom from one month to next. Quicktronics can also choose to delay an order by stocking out in a given month and filling the order in the next month (back order). This backorder cost to company is Rs. 10,000 in form of discounts offered to customers to keep them happy. Company has a policy that there were no stock outs in December, so that new year starts with no back orders. The material cost for each smartphone is Rs. 50,000 and price varies from Rs. 100,000 to 125,000.

Company ended December with 667 assembly teams and a million (1,000,000) phones in inventory. The production plan at the factory attempted to meet demand at the lowest possible cost.

a). What is annual cost of current plan where Mr. Hari Harsha maintain a workforce of 667 teams throughout the year? How much factory should produce? What is maximum inventory under this plan? **(5 Marks)**

b). How much Mr. Hari will reduce costs if he gives flexibility of hiring and firing teams as desired? How much factory should produce each month? What is maximum inventory under this plan? **(5 Marks)**

c). What are the pros and cons of these two plan and which one do you prefer? **(3 Marks)**

d). Formulate a linear program for above problem. **(4 Marks)**