

**K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,**  
**Vidyavihar, Mumbai- 400077**  
**Program: PGDM/MMS Ops (Batch 2018-20) Trim-IV**  
**Subject: Business Process Flows**  
**(End Term Examination) (In computer lab)**

Date : 21<sup>st</sup> Sep, 2019

Maximum Marks: 50

Duration: 3 hours

**Instructions**

- Write all your answers in the answer sheet clearly. Your submission in answer sheet will be primarily used for evaluation, supported by the excel submission.
- Use Excel as required and keep saving your work (one single file with reference of your program and roll no) as you proceed. Follow the instructions of data centre personnel and transfer your folder to an appropriate place in the server.
- If you assume any data not given, please provide suitable explanation of the same.

**Part A – Problems (Answer any 3 out of 5: 3X11=33 marks)**

1.

- a. A fast-food restaurant processes an average of 5000 kg of burgers per week. Typical inventory of raw meat in cold storage is 2500 kg.
  - What is the process? What is the flow unit in this case? (3)
  - What is the average flow time ?(3)
- b. Checking accounts at a local bank carry an average of Rs. 3000. The bank turns over its balance 6 times a year. On average, how many rupees flow through the bank each month? (5)

2. Cheapest Car rentals rents cars at the Chicago airport. The car rental market consists of two segments: the short-term segment, which rents for an average of 0.5 week, and the medium-term segment, which rents for an average of 2 weeks. Cheapest currently rents an average of 200 cars a week to the short-term segment and 100 cars per week to the medium-term segment.

Approximately 20 per cent of the cars returned (evenly distributed across both segments) are found to be defective, and in need of repairs before they can be made available for rent again. The remaining cars not needing repairs are cleaned, filled with gas, and made available for rent. On average, there are 100 cars waiting to be cleaned. The average cost of this operation is \$5 per car. Cars needing repairs spend an average of 2 weeks in the repair shop and incur an average cost of \$ 150 per car. Assume that cars are rented as soon as they are available for rent, that is, as soon as they have been cleaned or repaired. Short-term renters pay \$200 per week, while medium-term renters pay \$ 120 per week.

- Draw the flow chart for the process. (3)
  - Identify throughput, inventory, and flow time at each stage. (4)
  - What profit does Cheapest earn per week with the current system? Assume that each car loses \$ 40 per week because of depreciation. (4)
3. A home insurance application consists of two forms: F1, which relates to the home owner, and F2, which relates to the property. On receipt, each application is processed, recorded, and

separated into F1 and F2. This operation requires 10 minutes. F1 requires Activity A for 15 minutes per unit and then Activity B for 10 minutes per unit. F2 requires Activity C for 20 minutes per unit. F1 and F2 are then combined and further processed by a loan officer for 15 minutes. All the times mentioned represent flow time at the various activities, and include the effect of waiting.

- a. Draw a process flowchart of the complete process. (3)
  - b. What is the flow time? (4)
  - c. What is the effect on flow time if 50 per cent of F1 must repeat Activity A one more time due to quality problems? (4)
4. Three hairstylists, Fara, Bernie, and Mimi, run Fast Service Hair Salon for busy professionals in the Gold Coast area of downtown Chicago. They stay open from 6:45 a.m. to 9:00 p.m. in order to accommodate as many people's work schedules as possible. They perform only shampooing and hair styling activities. On average, it takes 10 minutes to shampoo, 15 minutes to style the hair, and 5 minutes to bill the customer. When a customer arrives, he or she first checks in with the receptionist which takes only 3 minutes. One of the three hairstylists then takes charge of the customer and performs all three activities – shampooing, styling, and billing – consecutively.
- a. Draw the flowchart for the process.(3)
  - b. What is the number of customers that can be served per hour in the hair salon? (4)
  - c. A customer, an operations specialist, has suggested that the billing operations be transferred to the receptionist. What would be impact on theoretical capacity?(4)
5. Victor sells a line of upscale evening dresses in his boutique. He charges \$ 300 per dress, and sales average 30 dresses per week. Currently, Victor orders a 10-week supply at a time from the manufacturer. He pays \$ 150 per dress, and it takes two weeks to receive each delivery. Victor estimates his administrative cost of placing each order at \$ 225. Because he estimates his cost of inventory at 20 % p.a.
- a. Compute Victor's total annual cost of ordering and carrying inventory. (3)
  - b. If Victor wishes to minimize his annual cost, when and how much should he order in each batch? What will be his annual cost? (4)
  - c. Compare the number of inventory turns under the current and proposed policies.(4)

### **Part B – Case Analysis ( answer any one out of two)**

6. An insurance company receives an average of 40 requests for underwriting per week. Through statistical analysis, the company has been able to determine that the time between two consecutive requests arriving to the process is adequately described by an exponential distribution. A single team handles the requests and is able to complete on average 50 requests per week. The requests have no particular priority; therefore, they are handled on a first-come-first-served basis. It also can be assumed that requests are not withdrawn and that a week consists of 40 working hours.
- You are required to develop a spreadsheet simulation (with 500 iterations) of this single-server queueing situation in the format given below: (5 marks)

Answer the following questions:

- a. What is the average waiting time? (3)

- b. What is the server utilization?(3)
- c. Apply the analytical process and identify theoretical values for important parameters.(3)
- d. Compare the simulation values and theoretical values and explain the difference.(3)

	Mean arrival rate					Average waiting time		
	Mean service rate					Server utilization		
			Arrival	Start	Service	Completion	Wait	Idle
	Customer	TBA	Time	Time	Time	Time	Time	Time
	1							
	2							
	3							
	4							
	5							
	196							
	197							
	198							
	199							
	200							

**OR**

7. Orange Juice Inc. produces and markets fruit juice. During the orange harvest season, trucks bring orange from the fields to the processing plant during a workday that runs from 7 a.m. to 6 p.m. On peak days, approximately 10000 kilograms of oranges are trucked in per hour. Trucks dump their contents in a holding bin with a storage capacity of 6000 kilograms. When the bin is full, incoming trucks must wait until it has sufficient available space. A conveyor moves oranges from the bin to the processing plant. The plant is configured to deal with an average harvesting day, and maximum throughput (flow rate) is 8000 kilograms per hour.
- a. Assuming that oranges arrive continuously over time, construct an inventory buildup diagram for the company. (5)
  - b. In order to process all the oranges delivered during the day, how long must the plant operate on peak days? (Assume that it cannot store oranges since the company makes fresh juices.)(4)
  - c. Assuming that each truck holds about 1000 kilograms of oranges, at what point during the day must a truck wait before unloading into the storage bin?(4)
  - d. What is the maximum time that a truck must wait?(4)

Relevant formulae

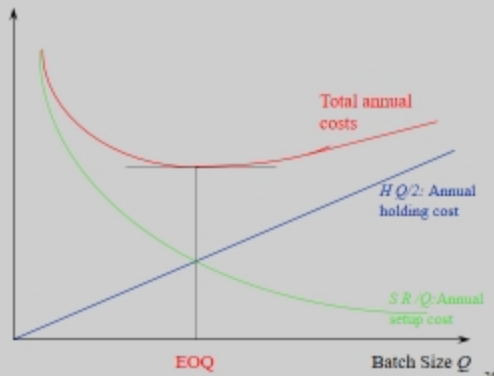
For EOQ

## Economies of Scale: Economic Order Quantity *EOQ*

- $R$  : Demand per year,  
 $S$  : Setup or Order Cost (\$/setup; \$/order),  
 $H$  : Marginal annual holding cost (\$/per unit per year),  
 $Q$  : Order quantity.

$$Q = \sqrt{\frac{2RS}{H}}$$

- $C$  : Cost per unit (\$/unit),  
 $r$  : Cost of capital (%/yr),  
 $h$  : Physical unit holding cost (\$/unit,yr),  
 $H = (h + r) C$ .



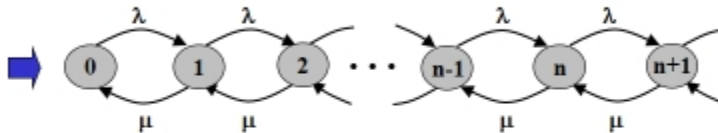
Chapter 6

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For M/M/1 model

## The M/M/1 Model

- $\lambda_n = \lambda$  and  $\mu_n = \mu$  for all values of  $n=0, 1, 2, \dots$



- ❖ Steady State condition:  $\rho = (\lambda/\mu) < 1$

$P_0 = 1 - \rho$        $P_n = \rho^n (1 - \rho)$        $P(n \geq k) = \rho^k$

$L = \rho / (1 - \rho)$        $L_q = \rho^2 / (1 - \rho) = L - \rho$   
 $W = L / \lambda = 1 / (\mu - \lambda)$        $W_q = L_q / \lambda = \lambda / (\mu(\mu - \lambda))$

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