

PGDM, 17-19

Supply Chain Analytics (DM-444)

Trimester-IV, End Term Examination, September 2018

Time allowed: 2 hr 30 min

Max Marks: 50

1. Anthony's Lobsters is a small seafood restaurant in Newport, Road Island. The place is famous for its lobsters, and customers flock in every day to try it. The arrival rate of the customers is 70/hour with a standard deviation of 60. Anthony's Lobsters has only one chef, but he is very efficient, and the restaurant can satisfy around 90 customers/hour with a standard deviation of 40.
 - a. What is the current utilization? (2 marks)
 - b. What is the expected time an order waits in the queue (in minutes)? (2 marks)
 - c. What is the expected flow time (total time in the system) in minutes? (2 marks)
 - d. What is the expected number of orders in process? (2 marks)
 - e. What is the expected number of orders waiting in the queue? (2 marks)
2. Assume you are the retailer who orders goods at \$3 an item from the manufacturer and sells it in stores at \$12 an item to customers. You decide your order quantity Q and place the ordered units on shelves before the uncertain demand is realized. Consider the following scenario: You decide to buy $Q = 100$ items and the customer demand turns out to be 87 items. Calculate the profit accrued in this scenario. (2 marks)
3. MedPlus Company owns pharmacies/drug stores in several US cities. Demand for Flu shots at a store in center-city Philadelphia, can be modelled by a random variable that takes the following values in five different scenarios that occur with the following probabilities.

Scenario 1: $D_1 = 10$ with probability $p_1 = 0.2$
Scenario 2: $D_2 = 20$ with probability $p_2 = 0.2$
Scenario 3: $D_3 = 40$ with probability $p_3 = 0.2$
Scenario 4: $D_4 = 60$ with probability $p_4 = 0.2$
Scenario 5: $D_5 = 80$ with probability $p_5 = 0.2$

What is the mean of this demand distribution? (3 marks)

4. Here is a table of the number of downloads observed in each of the past 20 periods of observation for a new pop song posted on MusicTunes in the App store.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
1	39	19	5	97	44	49	95	46	56	3	90	2	19	66	48	11	92	99	86

Using the 5-period Moving Averages, i.e., MA (5), calculate the forecasts for periods 6 through 20. Now calculate the errors in your forecasts. What is the Root Mean Squared Error from the data?

(10 marks)

5. Bharatiya Ghar (BG) is an Indian real-estate development company that has just finished building a hotel in Goa. BG's hotel has 150 luxury rooms, and the company needs to decide on the long-term price levels to be charged for the hotel rooms. In particular, BG considers a potential price level of ₹10000 per room per day. Based on the analysis of the market research

and past occupancy data, the company estimates that if it uses the ₹10000 price level, the daily demand for rooms at the hotel D will be distributed as a Poisson random variable with parameter $\lambda = 147$. The company assumes that if demand for rooms on a particular day exceeds 150, all extra room requests (above 150) will be lost to other hotels.

- a. Suppose the demand on a given day turns out to be 137. What is the total revenue that BG will receive on that day? (1 mark)
 - b. Suppose the demand on a given day turns out to be 153. What is the total revenue that BG will receive on that day? (1 mark)
 - c. What is the algebraic expression for the daily total revenue BG will receive, R , as a function of the daily demand D ? (2 marks)
 - d. Suppose that Excel's Random Number Generation tool has generated the following sequence of 5 random values from the Poisson distribution with parameter 147: 171, 148, 156, 157, 140. These values reflect 5 random daily demand values. What is the sample standard deviation of the BG's **daily total revenue** values corresponding to these demand values? (3 marks)
 - e. Use Excel to set up and run a simulation of the total daily revenue R using $n = 100$ simulation trials and the random seed of 123. Based on the results of this simulation, what are the estimates for the expected value and the standard deviation of the total daily revenue? (8 marks)
6. Power Cycle makes meters that gauge the speed and power with which cyclists ride their bikes. An electronic sensor, connected to the bicycle's pedal, communicates via Bluetooth to the rider's iPhone or Android phone.

Power Cycle buys the device's Bluetooth interface from an outside vendor that has offered the following terms.

- i. The vendor will deliver 50,000 interfaces to Power Cycle 60 days from now.
- ii. Power Cycle has the option to buy another 50,000 interfaces for delivery 120 days from now.
- iii. If it wants to buy the 2nd set of 50,000 interfaces, Power Cycle must let the supplier know at least 30 days before delivery; that is, by 90 days from now.
- iv. Power Cycle will pay £5 per unit for the interfaces.

The supplier incurs a fixed cost of £125,000 for *each* production run, plus a per-unit cost of £2 for each interface produced. The manufacturer believes that there is a 60% chance that Power Cycle will request the 2nd set of 50,000 interfaces, and it wants to decide which of the following options it should choose: 1) Enter into the contract, produce 50,000 units now, and produce a 2nd set of 50,000 units only if Power Cycle requests them later. 2) Enter into the contract, produce 100,000 units now, and bear the risk that Power Cycle does not reorder. If the supplier chooses option 2 and Power Cycle orders only 50,000 units in total, the leftover 50,000 units will have no salvage value for the supplier.

- a. Structure the supplier's choices using a decision tree. Make sure you explicitly define all of the elements of the tree: decisions, events, cash flows and probabilities associated with decisions and events, and payouts associated with the final outcomes. (6 marks)
- b. What are the maxi-min, maxi-max, and expected value maximizing decisions for the supplier? What are the monetary values associated with those choices? (4 marks)