Process Analysis and Improvement (DM- 443/IB-418)

Trimester-IV, End-Term Examination: September 2017

Time Allowed: 2 ½ hours   Max Marks: 50

Roll No:

Instruction: Students are required to write Roll No on every page of the question paper. Writing **anything except** the Roll No will be treated as Unfair Means. In case of rough work please use the answer sheet.

Section A

Please attempt any THREE questions. Each question carries 5 marks. **Please be brief.**

A1.   What is a business process? Name one critical business process for BIMTECH. Why is it critical? Mention the steps that can be taken to significantly improve your chosen process.

A2.   Consider a sequential multi-stage process employing labour that gets paid at a fixed rate (per hour). You measure the labour content in each flow unit that goes through this process (money/unit). How will you reduce the labour content
   a.   If the process is demand constrained,
   b.   If the process is capacity constrained.

A3.   In a large hospital, there are 10 births per day. 80% of the deliveries are easy and require mother and baby to stay for 2 days; 20% of the cases are more complicated and require a 5 day stay. What is the average occupancy of the department?

A4.   Remember 'buffer or suffer'? In McDonalds sandwiches wait for customers, while in Subway customers wait for sandwiches. What the pros and cons (pluses and minuses) of each of these strategies?

A5.   Remember quartile analysis? BIMTECH wishes to significantly improve the research productivity of its faculty members and research scholars. How will it use quartile analysis to achieve this goal?

Section B

Please attempt any TWO questions. Each question carries 10 marks.

B1.   Infusion US is a start-up that offers powerful and energizing infusions in a non-hospital setting for athletes (just electrolytes, ☺). The service process includes five activities that are conducted in the sequence described below. (The time required for each activity is shown in parentheses).

   Activity 1: Welcome and explain procedure   (7 min)

   Activity 2: Take vitals, insert IV, and take blood   (13 min)

   Activity 3: Mix infusion treatment   (12 min)

   Activity 4: Infusion   (30 min)

Activity 5: Debrief   (5 min)

Three nurses (S1, S2 and S3) offer the services in a worker paced line. The assignment of activities to the nurses is given below.

S1 – Activity 1 and Activity 2

S2 – Activity 3

S3 – Activity 4 and Activity 5

Assume the demand to be unlimited and that the process admits patients at the rate of the bottleneck.

a. Which nurse is the bottleneck of the process? (2 marks)
b. What is the utilization of nurse 2? (2 marks)
c. What is the cycle time in minutes? (2 marks)
d. What is the average labour utilization across all three nurses? (2 marks)
e. What are the direct labour costs associated with serving one patient? Assume wages @ $30/h for nurses 1 and 2, and $60/h for nurse 3. (2 marks)

B2. Line balancing is a critical aspect of an assembly line. Consider an assembly line comprising 11 operations, as listed in the table below. Please note that combination of tasks at one station of the line is possible.

Sequence	Task	Task time (min)
1	A	20
2	B	10
3	C	5
4	D	10
5	E	15
6	F	5
7	G	10
8	H	30
9	I	10
10	J	5
11	K	30

a. Assume that the process is capacity constrained (there is enough demand), and that each task is performed by one worker. What is the maximum capacity of this line? (2 marks)
b. Create a balanced line that achieves the maximum capacity, without disturbing the sequence of the tasks. How many stations will you need (draw a schematic diagram of stations and assigned tasks)? (2 marks)
c. What will be the average labour utilization of the line (created in part b)? (2 marks)

d. If shuffling of tasks were allowed, would your line differ from the one created in part b? Illustrate with a diagram of the new line. (2 marks)

e. What will be the average labour utilization now? (2 marks)

B3. Toyota Motor Company's Taichi Ohno: "All we are doing is looking at the time line from the moment the customer gives us an order to the point when we collect the cash, and we are striving to reduce that time line."

a. Assume that Ohno is referring to the time spent in making and selling a car from scratch. Why is Ohno concerned with reducing this time? You may use Little's Law in answering if you so wish.

b. Name four ways in which Toyota reduces this scratch-to-sale time. Please explain briefly each of the ways as to how it helps reduce this time

Section C

(This section refers to the case 'National Cranberry Cooperative' circulated already).

With respect to the case 'National Cranberry Cooperative' please answer the following questions.

1. Draw the process flow diagram for the 'process berries' (both dry and wet) starting with the holding bins and ending with the Jumbo separators. Label the capacity for each stage. Identify the bottleneck. (3 marks)

2. The problems that Hugo Schaeffer is trying to solve are the overtime costs and the waiting time of trucks. These problems are more likely on days when the inflow rate of berries shoots up.

   a. What is the peak inflow rate (per hour) of dry and wet berries? Refer to Exhibit 2 to answer this. Is the process capacity constrained?

   b. A peak load day is a heavy day and on a heavy day the processing of incoming berries starts at 11 am (refer to Figure E), four hours after the first incoming truck. Assuming a uniform rate of inflow of wet berries and using your answer from part a of this question, how much inventory (number of barrels) is built up before the processing starts at 11 am? If the maximum capacity for wet holding bins is used, when do trucks start waiting?

   c. At what rate does the wet berry inventory build up once the processing has started at 11 am?

   d. What is the maximum level that the inventory of wet berries reaches on a peak day? Remember, inventory builds up till 7 pm when the last truck comes in.

   e. At what rate does the inventory diminish after 7 pm? And therefore at what time (approx.) does the inventory reduce to zero?

   f. Till what time do incoming trucks have to wait?

   (6 marks)

3. Hugo Schaeffer feels that part of the problem of overtime and waiting trucks can be solved by starting the processing at 7 am instead of at 11 am. If the processing at RP1 starts at 7 am

a. At what time do trucks start to wait?
b. What is the peak inventory of wet berries?
c. At what time does the inventory of wet berries reduce to zero? Has this rescheduling of processing start time reduced the overtime hours? By how much?

(3 marks)

4. After studying the effect of starting the processing early, it is proposed to add an additional drying unit (200 bbls/h) to increase the drying capacity to 800 bbls/h. Now with this additional drying unit and the processing starting at 7 am
   a. From what time till what time do trucks have to wait?
   b. What is the maximum number of trucks waiting?
   c. At what time does the inventory of wet berries reduce to zero?

(3 marks)