PGDM/PGDM-IB, 2017-19

Process Analysis and Improvement (DM-342/IB-318)

Trimester-III, End-Term Examination: March 2018

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. A hungry customer is about to enter a fast food restaurant. How will you measure the capacity of the restaurant? State one way in which you can improve the capacity.

A2. The cumulative number of customers arriving at a retail bank branch is recorded as a function of time, and the cumulative number of customers leaving the branch is also counted as a function of time. What would be the plot of these numbers versus time look like (please draw). If you consider that the branch 'processes' each customer, what parameters of the process can you measure using your plot? Please show these on the plot.

A3. A six sigma process produces only about 3 defects per million opportunities (DPMO). Using the case of Flyrock Tyres, or any other suitable example, state two benefits of a six sigma process.

A4. Inventory and waiting (customers waiting for resources, or resources waiting for customers) are both considered as waste. Explain why? Give one way in which you can reduce these wastes.

A5. Consider the baggage check-in of a small airline. Check-in data indicate that from 9 a.m. to 10 a.m., 255 passengers checked in. Moreover, based on counting the number of passengers waiting in line, airport management found that the average number of passengers waiting for check-in was 35. How long did the average passenger have to wait in line?

Section B

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

B1. As an equipment provider for several Olympic cyclists, Carbon Bike Frames (CBF) operates a very expensive wind tunnel facility near San Diego, CA. The wind tunnel is used to find the best compromise between ergonomics and aerodynamics for the cyclist. Presently, more and more cyclists are interested in CBF's services, so the company considers building a second facility. However, given the enormous costs of the wind tunnel, they also want to explore a more effective use of the current facility. An initial data collection reveals that:

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- The standard fitting time for a cyclist is 2h. On average, the wind tunnel is used for 7 fitting procedures a day (new customers or customers who want a *refit*). The wind tunnel is available 24 hours a day.
- CBF offers a free second session should the customer not be entirely satisfied with their bike fit (internally also known as "rework sessions"). About 2 out of 5 customers come back for such a "*refit*," which takes the same amount of time as the initial fit. Assume that a *refit* customer is completely satisfied after the refit.
- 20 minutes (in addition to the standard time) of the each fitting procedure is spent on setting up the bike on a stationary trainer and getting the athlete ready. Almost all of this could happen outside the wind tunnel, i.e. while another fitting procedure is still going on.
- About one day out of 10, the wind tunnel is down for maintenance or repair.

a. How many new fits are conducted on a typical day when the wind tunnel is in use (assume the wind tunnel is open that day)? Remember that of the 7 fitments done on a day, some are refitment cases and a refitment case is always 'OK'. (3 marks)
b. What is the OEE of the wind tunnel? The value-add time is what is spent on new fitments. Rework time does not add value. Recall that the wind tunnel can be used 24h a day. (2 marks)

B2. Consider a process consisting of five resources that are operated eight hours per day. The process works on three different products, A, B, and C:

Resource	Number of Workers	Processing time for A (min)	Processing time for B (min)	Processing time for C (min)
1	2	5	5	5
2	2	4	4	5
3	1	12	0	0
4	1	0	3	3
5	2	6	6	4

Demand for the three different products is as follows: product A, 40 units per day; product B, 50 units per day; and product C, 60 units per day.

a. What is the total time available at each resource in a day (in *worker-minutes*)? (3 marks)
b. Considering the demand for products A, B and C, what is the total time required at each resource in a day? (4 marks)
c. What is the implied utilization of each resource? Which resource is the bottleneck? (3 marks)

B3. A hospital in a developing nation is forced to manually put the flu shot vaccine into syringes. The recommended dosage for the flu shot is 0.5mL. The local health authorities define all syringes that have less than 0.45ml or more than 0.55mL as defective.

In a sample of 100 syringes, the hospital's quality control officer finds the average dosage to be 0.5mL. The standard deviation of the dosage is 0.02 mL and the distribution of the dosages resembles a normal distribution reasonably closely.

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a. What is the process capability of the manual filling process? (3 marks)

b. What percentage of the manually filled syringes will be outside the specification limits provided by the local health authorities? (3 marks)
c. To what level would the hospital have to reduce the standard deviation of the operation if his goal were to obtain a process capability of Cp=4/3 (i.e., get 63 defects per million)? (4 marks)

Section C

Atlantic Corporation produces plastic molded components for the home appliance industry. The information presented here was collected by a team of University of Illinois students and is related to a value stream for producing a family of plastic moldings at Atlantic's Sacramento, Texas manufacturing facility.

These components are shipped daily by truck to an assembly plant owned by Stanley Appliances located outside of Houston, Texas. Stanley Appliances requires 12,600 pieces of molded components per month. Atlantic's production control department receives 6-week sales forecasts by weekly email from Stanley to help with production planning for specific requirements among the product family. Firm orders are received daily through an Internet based system.

The main raw material—polyvinyl chloride (PVC) granules—is purchased from Reliance Petrochemicals and delivered to the Atlantic manufacturing facility once a week based on weekly orders placed by the production control department.

The Atlantic manufacturing facility runs 20 days per month, one shift per day. A shift is eight hours with one 30-minute and two 15-minute breaks, during which work stops. The manufacturing process at Atlantic is largely divided into three operational tasks—molding of sub-components, sub-assembly, and final assembly. The production control department issues orders every morning specifying details of the work to be completed in each of these three operations.

During their walk through the facility, the Illinois team observed and computed based on weight that there were enough PVC granules in storage for 1,890 pieces of finished components. There were two workstations with two employees working in parallel on molding, and each molded sub-component required for 50 finished components were produced in one hour. The average setup time for changing the settings on the molding machine for different subcomponents was 75 minutes. There were enough sub-components in inventory after the molding task for 945 finished components.

The sub-assembly task had one workstation with one employee who produced sub-assemblies for 45 finished components in thirty minutes. The average setup time for replacing the fixtures and tools required for the different types of components was 25 minutes. There were 630 sub-assemblies in inventory after this task.

The final assembly task had three employees in three workstations. In 30 minutes, one employee had finished assembling and readying for shipment 4 boxes of 5 components each. There were 300 boxes, each consisting of five components of finished goods inventory, ready to be picked for shipment to Stanley's assembly plant.

C1. Draw a process flow diagram for the production process described in the case. (2 marks)
C2. What is the tact time in seconds? Compute the process time, cycle time, and the implied utilization for each stage of the process. (6 marks)
C3. What is the total value-add time for each flow unit? Compare this with the total waiting time of a flow unit on average. (3 marks)
C4. Suggest how you will make the process leaner. Please be precise. (3 marks)