UNIVERSITY
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MODULE	:	**Supply Chain Operations Management: A Business Process Approach**
CODE	:	**BML9X03**
DATE	:	**24 November 2016**
DURATION	:	**3 HOURS**
TOTAL MARKS	:	**65**

EXAMINER	:	**Prof S Gupta**
MODERATOR	:	**Prof JA Badenhorst-Weiss (UNISA)**
NUMBER OF PAGES	:	**11 PAGES**

INSTRUCTIONS TO CANDIDATES:

- Question papers must be handed in.
- This is an open book assessment.
- Read the questions carefully and answer only what is asked.
- Number your answers clearly.
- Write neatly and legibly.
- Structure your answers by using appropriate headings and sub headings.
- The general University of Johannesburg policies, procedures and rules pertaining to written assessments apply to this assessment.

General Instructions

This exam is open book / readings, open class handouts and open class notes. Calculators may be used. However, no form of communication, electronic or otherwise, is permitted during the exam. This includes web access, email or use of cell phones.

Please make sure to summarize your logic, steps taken to answer the questions, and your answers, in the appropriate space provided in the exam booklet. . **Supporting work must be shown in a clear and logical manner for credit to be given.** Maximum points possible are indicated below for each question.

STUDENT NUMBER: ....

NAME (print): .... **(Sign):** ....

My signature attests that I have taken this exam in accordance with the University of Johannesburg Honor Code.

YOU HAVE A MAXIMUM OF THREE HOURS TO DO THIS EXAM.

Q. No.	Maximum Points	Points Scored
1.	15	
2.	15	
3.	20	
4.	15	
Total	65	

QUESTION 1   **15 MARKS**

A car repair shop has two hoists where cars can be lifted for repair work. Currently customers come in at the rate of 4 per hour and are processed at a similar rate. On average 8 cars are waiting to be processed, 4 needing routine repairs and 4 needing major repairs. People are served on a first come first serve basis.

(a) How long do customers wait on average before being processed?   **(5)**

(b) The repair shop owner feels that he is losing many customers needing routine repair because of the long wait. He dedicates one hoist for routine repair and one for major repairs. A study indicates that routine repairs are processed at the rate of 3 per hour and major repairs at the rate of 1 per hour. There are now 5 people waiting on average for routine repairs and 3 waiting on average for major repairs. How long does each type of customer now wait before being served?   **(5)**

(c) With the new system, what is the average waiting time over all customers?   **(5)**

QUESTION 2   **15 MARKS**

ABC is a supplier of industrial parts in the US. All orders are received at a central call center. The call center has a sufficient number of phone lines such that no caller ever receives a busy signal. The call center currently has 4 service representatives (SR). All callers join the same queue and are routed to the next available SR on a first-come-first-served basis. The average time between two callers is 2 minutes. Each SR takes on average 6 minutes to serve a customer. Assume that the inter-arrival time and the service times are exponentially distributed. ABC estimates that waiting costs incurred are $1 per customer per minute in terms of phone charges and loss of future business. Assume that callers do not abandon once they enter the system. SRs are paid $20 per hour.

(a)   What is the total hourly cost (customer waiting costs plus wages for SRs) to ABC of the current configuration of the call center?   **(8)**

(b)   To improve service, the company decides to have dedicated SRs for each region. It divided the country into four regions. Callers from a region are routed to a dedicated SR for that region. The average time between callers for each region is shown below. Assume all inter-arrival times are exponentially distributed.

	Region 1	Region 2	Region 3	Region 4
Average Time between calls	9 mins	9 mins	7 mins	7 mins

Each SR still takes on average 6 minutes to serve a customer, and this time is also exponentially distributed. What is the new average hourly cost for ABC?   **(7)**

QUESTION 3   20 MARKS

Del Popolo's pizza production process, which occurs entirely inside a food truck, is as follows: The first step is to take the customer order and collect payment at the order window, which takes 15 seconds. For simplicity, assume each customer only orders a single pizza. In the second step, a pre-sized ball of pizza dough is removed from the refrigerated rack, then stretched and tossed into a round pizza shape, which takes 20 seconds. The third step is to apply the sauce and the various toppings to the pizza round based on the specified order, which takes 10 seconds. In the fourth step, the pizza is baked in the wood-fired oven, which takes 75 seconds. Note that the oven can hold a maximum of four pizzas at once. The fifth and final step, which takes 5 seconds, is to box the pizza and make it available at the pick-up window for the hungry customer.

The following assumptions should be made (unless otherwise stated):
1. The food truck serves customers 5 hours per day, Monday – Friday.
2. The other 3 hours per day (in the morning and evening) are used for setup, cleanup, and preparation of the materials (dough, tomato sauce, and other ingredients, as previously described).
3. Process startup and shutdown times can be ignored.
4. Person A is dedicated to the order taking and boxing steps of the process.
5. Person B is dedicated to the dough shaping and application-of-the-sauce-and-toppings steps of the process.
6. Person C is dedicated to the baking step of the process.
7. The process is operating in a steady-state condition.

a)   Draw a flowchart of the process indicating the *time in seconds* required to complete each step and the resources consumed. Be sure to include appropriate units at each step as well.   **(5)**

b) Calculate the *hourly and daily* capacity of each step.   **(5)**

Process Step	Hourly and Daily Capacity
Take order & collect payment	
Stretch & toss pizza dough	
Apply sauce & pizza toppings	
Bake pizza in wood-fired oven	
Box pizza & make available for pick-up	

c)   Where is the bottleneck in the process? How many pizzas can Del Popolo produce per 5-hour workday?   **(2)**

d) If Del Popolo has no other orders ahead of you, how long will it take you to get your pizza?
                                                                                                                                                (2)

e) Jon is thinking about adding one more person to the process. Where should he add the person? What effect does this have on the bottleneck, flow time and capacity of the process? How would you determine whether or not it is worth adding another person? What other changes might you make to the process to increase capacity? **(6)**

QUESTION 4
15 MARKS

The Starck Company, an 80-year old manufacturer based in the Midwest, fabricates a wide assortment of metal housings for motors and other electrical equipment. While the products require basically the same kinds of processing, they differ in size, in the gauge of metal used, and in the type of metal used. Starck has long-term contracts with its various customers. Its customers insist that Starck keep finished goods inventories of the housings they use. Demand is reasonably stable from week to week as to total quantity shipped, although not for individual models (products). Housings are fabricated in batches, usually of at least 500 at a time. Materials for each batch are assembled in the controlled, fenced–off storeroom and then released to the factory floor, along with the appropriate paperwork. The major process steps through which a typical housing include the following: (1) cutting metal to length from coiled stock, (2) stamping on variously sized stamping presses, (3) welding of selected parts, (4) drilling and riveting of other parts, (5) deburring, (6) painting, if that was called for by the customer, and (7) labeling the finished pieces with the customer's logo.

The metal pieces for each batch were kept in large bins that were moved by forklift truck from one work center to another. Changeovers for each new batch took differing amounts of time on various machines (e.g., the stamping presses took several hours for most changeovers, while drilling and welding took only about half an hour).

The factory was organized conventionally, with the different manufacturing functions each in their own department (i.e., a cut-to-length department, a stamping department, a welding department, a paint department). Each department had its own supervisor, with the supervisors reporting to a manufacturing superintendent, who in turn reported to the plant manager. The supervisors were evaluated on their labor efficiency (earned hours versus total available hours), and machine utilization (percent time spent actually setting up and producing parts).

Over the past few years, management had begun to worry that inventories, especially work-in-process, had been growing out of control, that quality had been slipping somewhat, and the productivity had not budged much at all.

Management has approached you to investigate whether Lean Manufacturing could be applied in this plant. Based on the facts provided above, provide a brief (in the space below) report on what are some of the key aspects that Starck should focus on and how changes should take place to facilitate lean manufacturing. *Do not provide generic answers. Your answers should be based on the case provided above and include specific pointers to facts above.*