**Commerce 398-201 Winter 2014-2015 Term ANSWERS**

Assignment 2
Due at beginning of class March 3, 2015

Please do all questions in order. Marks in parenthesis is the maximum mark for answers to the questions;

1. How would you characterize the most important difference for the following issues when comparing a facility organized with work centres versus a continuous process? (6)

**Answer**
*Work centres would require more frequent changeovers, but they could be done independently, while a continuous process would try to minimize changeovers due to the significant coordination required to setup the line for a new product. Work centres would typically have more labour content, while a continuous process would have more specialized machines that remove labour from the process. Work centre arrangements provide more flexibility in the kinds of different products produced at any point in time, and are also more flexible when introducing new products. To achieve similar flexibility with a continuous process requires significant planning and investment.*

2. Strohrmannm a large-scale bakery in Vancouver is laying out a new production process for their packaged bread, which they sell to several grocery chains such as Safeway, Whole Earth Foods and Costco. It takes 12 minutes to bake the bread. How large an oven is required so that the company is able to produce 4000 units of bread per hour (measured in the number of units that can be baked simultaneously? Show all your work. (5)

**Answer**
*The bread needs to be in the oven for 12 minutes (flow time). We want to produce at a flow rate of 4000 breads per hour, or 4000/60=66.66 breads per minute.*
*Inventory=Flow Rate * Flow Time: Inventory=66.66 breads per minute* 12 minutes. Thus, Inventory=800 breads, which is the required size of the oven*

3. Explain how having more work-in-process inventory can improve the efficiency of a process? How can this ever be bad? (8)

**Answer**
*More work-in-process inventory can be used to buffer multiple stage processes. Specifically, it can help with blocking or starving. Blocking is when the activities in the stage must stop because there is no place to deposit the item just completed. Starving is when the activities in a stage must stop because there is no work. Buffer inventories between operations can help relieve these problems, and improve the efficiency of the overall process. Increasing work-in-process inventory can be bad in that it involves more investment in inventory, as well as taking-up valuable floor space. Also, the JIT philosophy view work-in-process as being negative for a variety of reasons.*

4. Andrew and Lorra are flying to Hawaii for reading week. They are friends who met in an operations course, 'Introduction to Operations & Logistics'. They chat on the bus taking them to the airport and remark that hopefully what they had learned in the course will

help them navigate the large terminal building at Vancouver airport which would be crowded at this time due to the one week break. As they understand it there are 4 types of travellers: *experienced short distance* who check in online and don't speak to any airline agent or use a check-in kiosk; *experienced long distance* travellers who spend 3 minutes with an agent; *inexperienced short distance* travellers who spend 2 minutes at a check-in kiosk but no time with an agent and, *inexperienced long distance* travellers who spend 5 minutes with the agent.

Each passenger must pass through security which takes 0.5 minutes regardless of who they are. The airport has experienced the arrival rates of the different travellers as: experienced short distance 100 per hour, experienced long distance 80 per hour, inexperienced short distance 80 per hour and inexperienced long distance 40 per hour.

In the terminal there are four security check lines, six airline agents and three electronic kiosks. Passengers arrive uniformly from 10:00 AM to 2:00PM with the entire system empty prior to 10:00 AM and no passengers arrive after 2:00PM.

(a) What are the implied levels of utilization of each resource?(6)

**Answer:**

*The implied utilization levels of the resources are computed as follows*

| | Servers | Avail. Min/Hr | Requested | Imp. Util. | |
|---|---|---|---|---|---|
| Security | 4 | 240 | 150 | 62.50% | |
| Agents | 6 | 360 | 440 | 122.22% | |
| Kiosk | 3 | 180 | 160 | 88.89% | |

(b) At what time has the last passenger passed through the system? (Note: if passengers of one type have to wait for a resource, passengers that do not need that resource can pass the waiting passengers) (5)

**Answer**

*The backlog at the bottleneck accumulates at a rate of 80 "requested minutes" per hour. After 4 hours this is 4*80 = 320 "requested minutes" of work from the agents. This takes 6 agents 320/360 = 8/9 = 0.89 hours to complete, or 53.4 minutes after the last arrival*

(c) Andrew and Lorra are both experienced long distance travellers and arrive at 10:00 AM hoping to get through quickly. How long did they have to wait before getting checked at security? (5)

**Answer**

*When Andrew and Lorra arrive,we can assume that a certain number of passengers arrive with them. The question states the distribution of passengers is 'uniform'. Therefore, there will be 100/60 experienced short distance (eSH) travellers, 80/60 experienced long distance (eLH) travellers, 80/60 inexperienced short distance (iSH) travellers and 40/60 inexperienced long distance (iLH) travellers. Lorra and Andrew are experienced LH travellers so need 3 minutes of agents time. However, we know the iSH use a kiosk which is not a bottleneck, the eLH travelers will need (80/60) x 3=4 minutes and iLH will need (40/6) x 5=3.3 minutes, so a total of 7.3 minutes of agents time. The agents, can process at the rate of 6 minutes per minute since there are 6 of them, therefore it will take the 6 agents 1.22 minute to process people in front of Andrew & Lorra. Andrew & Lorra take 3 minutes to complete service with the agent and 30 seconds to pass through security (there is no line at security) so the answer is 4.72 minutes or 4 minutes and 42 seconds*

(d) The airline is considering showing passengers an 'educational video' that would assist them in learning the check-in process. Surveys indicate that 80 percent inexperienced travellers (short and long haul) would act as experienced travellers; so new arrival rates would be 164 experienced short distance, 112 experienced long distance, 16 inexperienced short distance and 8 inexperienced long distance. At what time is the last passenger gone through the system? (6)

**Answer**

*We compute the new utilizations as follows:*

| | Servers | Avail. Min/Hr | Requested | Imp. Util. | |
|---|---|---|---|---|---|
| Security | 4 | 240 | 150 | 62.50% | |
| Agents | 6 | 360 | 376 | 104.44% | |
| Kiosk | 3 | 180 | 32 | 17.78% | |

*Extra work accumulates at a rate of 16 minutes per hour for the agents, for a total of 64 minutes after the last arrival. This takes the 6 agents 64/360 = 0.178 hours = 10.7 minutes to complete, so 8:10 PM is the closest answer.*

5. What are the implied levels of utilization of each resource?(6)

5. In the Toyota Production System, *jidoka* refers to:

a. Level production, where different models are produced along side each other on the assembly line
b. Continuous improvement, where workers organize meetings to discuss ways of improving the production process
c. The inventory retrieval system where parts are replenished only when they are needed
d. The aggressive reduction of changeover and setup times
e. Continuous line-balancing to maximize utilization
f. The cross-training of workers for a wide range of skills
**g. None of the above (correct Answer)**

Provide the correct answer (5)

Correct answer is g.

**Total 46**