MGT 40750 – Quantitative Decision Modeling Spring 2017

**Assignment 1: Process Simulation**

***Due Date: 02/01/2017 (Wednesday)***

**Name(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*Make sure all your group members (no more than 3) sign here.*

There are five questions (15 total points) in this assignment. Solve these questions in SimQuick and fill in the solution template provided below.

**Question 1: Exercise 1 on page 33 in the SimQuick book.**

1. Report the overall mean cycle times in Line in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| # of Tellers = | 1 | 2 | 3 |
| Overall mean cycle time in Line = |  |  |  |

What’s the impact of adding tellers on the waiting times of customers?

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1. Report the overall mean cycle times in Line in the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time between arrivals = | 2 | 1.8 | 1.6 | 1.4 | 1.2 |
| Overall mean cycle time in Line = |  |  |  |  |  |

What’s the impact of the potential promotions in an effort to increase the number of customers on the waiting times of customers?

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**Question 2: Exercise 3 on page 34 in the SimQuick book.**

*Hint for model setup: Because there are only 10 phone lines, the number of CS people plus the capacity of Line must be 10.*

Report the overall mean cycle times in Line and the overall mean service levels in the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| # of CS people = | 1 | 2 | 3 | 4 | 5 |
| Overall mean cycle time in Line = |  |  |  |  |  |
| Overall mean service level = |  |  |  |  |  |

How many CS people would you recommend for the day shift? (The minimum number of CS people that satisfied both the waiting time requirement and the service level requirement.)

\_\_\_\_\_\_\_\_\_

*For the setting with your recommended number of CS people*, record your SimQuick configurations below:

**Entrances:**



**Buffers:**



**Work Stations:**







**Question 3: Exercise 7 on page 42 in the SimQuick book.**

1. **Create a complete process flow map using SimQuick elements:**

Report the overall mean fraction time working (utilization) for each Work Station in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Station: | Desk | Ambulatory | X-ray | Lab |
| Overall mean fraction time working = |  |  |  |  |

Report the overall mean cycle time for each Buffer in front of a Work Station in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Buffer: | Desk Line | Ambulatory Line | X-ray Line | Lab Line |
| Overall mean cycle time = |  |  |  |  |

Which Work Station is a bottleneck based on the above results? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Double the capacity of the bottleneck by adding an identical Work Station next to the existing one.**

Report the new overall mean fraction time working (utilization) for each Work Station in the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Work Station: | Desk | Ambulatory | X-ray | Lab | The added Work Station |
| Overall mean fraction time working = |  |  |  |  |  |

Report the new overall mean cycle time for each Buffer in front of a Work Station in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Buffer: | Desk Line | Ambulatory Line | X-ray Line | Lab Line |
| Overall mean cycle time = |  |  |  |  |

How has the bottleneck been affected?

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1. **Suppose the time between arrivals drops to 10 minutes.**

Report the new overall mean fraction time working (utilization) for each Work Station in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Station: | Desk | Ambulatory | X-ray | Lab |
| Overall mean fraction time working = |  |  |  |  |

Report the new overall mean cycle time for each Buffer in front of a Work Station in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Buffer: | Desk Line | Ambulatory Line | X-ray Line | Lab Line |
| Overall mean cycle time = |  |  |  |  |

How has the bottleneck been affected?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Question 4: Exercise 13 on page 59 in the SimQuick book.**

1. Report the overall mean service level for Purchase Requests in the following table:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Capacity of Storage = | 70 | 74 | 78 | 82 | 86 | 90 | 94 |
| Overall mean service level for Purchase Requests = |  |  |  |  |  |  |  |

Report the overall mean cycle time of simulated loaves in Storage in the following table:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Capacity of Storage = | 70 | 74 | 78 | 82 | 86 | 90 | 94 |
| Overall mean cycle time in Storage = |  |  |  |  |  |  |  |

What level of inventory do you recommend to achieve a service level of .99?

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1. Suppose the bakery make deliveries every day instead of every other day.

Report the new overall mean service level for Purchase Requests in the following table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Capacity of Storage = | 34 | 38 | 42 | 46 | 50 | 54 |
| Overall mean service level for Purchase Requests = |  |  |  |  |  |  |

Report the new overall mean cycle time of simulated loaves in Storage in the following table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Capacity of Storage = | 34 | 38 | 42 | 46 | 50 | 54 |
| Overall mean cycle time in Storage = |  |  |  |  |  |  |

What level of inventory do you recommend to achieve a service level of .99?

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**Question 5: Exercise 19 on page 81 in the SimQuick book.**

1. The overall mean throughput is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  
   The overall mean cycle time through the process from the time it enters WS1 to the time it leaves WS3 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. The overall mean throughput is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  
   The overall mean cycle time through the process from the time it enters WS1 to the time it leaves WS3 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. The overall mean throughput is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  
   The overall mean cycle time through the process from the time it enters WS1 to the time it leaves WS3 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. Report the overall mean throughput and the overall mean cycle time through the process in the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Capacity of both Buffers = | 1 | 3 | 5 | 7 | 9 |
| Overall mean throughput = |  |  |  |  |  |
| Overall mean cycle time through the process = |  |  |  |  |  |

1. The overall mean throughput is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  
   The overall mean cycle time through the process from the time it enters WS1 to the time it leaves WS3 is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Summarize your results from parts a through e. In particular, discuss the relationship between inventory, working time variability, throughput, and cycle time.

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1. Report the overall mean inventory and the overall mean maximum inventory of the added Buffers in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| Time units = | 2000 | 5000 | 10000 |
| Overall mean inventory at the Buffer between WS1 and WS2 = |  |  |  |
| Overall mean maximum inventory at the Buffer between WS1 and WS2 = |  |  |  |
| Overall mean inventory at the Buffer between WS2 and WS3 = |  |  |  |
| Overall mean maximum inventory at the Buffer between WS2 and WS3 = |  |  |  |

What does this imply about inventory levels in a factory where Buffer sizes are large and production runs are long?

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