**ISyE 3104 Exam 2 – Part II of II**

**Instructor: Damon P. Williams, Ph.D.**

Name (Print Neatly): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Point values are indicated next to each problem – please take these into consideration as you budget your time during the exam. If you are having difficulty with a question, sometimes it is beneficial to work on another question, and then come back.

You must show your work in order to receive full credit. Clearly identify your final answers (with a box, etc.) A lack of neatness and legibility can result in a reduction of your grade.

This is a closed book, closed notes exam; you are permitted to use the following in the exam:

* Calculator
* Pencil & erasers

You are obligated to comply with the Honor Code of Georgia Tech. You are not allowed to receive or give aid on this examination; in particular, you are not allowed to discuss this exam with anyone who may be taking it at a later date.

**Please write the following Honor Pledge:**

“I have neither given nor received aid on this examination,” and sign your name below.

*Instructors are not required to grade tests in which the signed Honor Pledge does not appear.*

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Point Summary**

|  |  |  |
| --- | --- | --- |
| **Question** | **Points** | **Out of** |
| Short Answer # 2 |  | 32 |
| Short Answer # 3 |  | 20 |
| Short Answer # 4 |  | 21 |
| **Part II Subtotal** |  | **73** |

**Short Answer (Cont’d) – Solve the following. Show all of your work. Write neatly and legibly. Place a box around your final answers.**

1. The Jacket Motors has developed an innovative process for manufacturing custom body parts for motorcycles. Designs are received as CAD files, which are used to configure a "bed of nails" fixture on which a robot places multiple layers of composite tape. Once the layup process is complete, the fixture goes through a curing process that uses ultraviolet light. Georgina Burdell, the company president, has brought you in as a consultant, because WIP levels and cycle times are excessive, leading to poor customer service, which is beginning to damage Jacket's reputation. As the senior consultant on the team, you've had your new hires from MIT collect data for you while you go to lunch with Ms. Burdell. Upon returning from lunch, you are presented with the following information:

The shop works a single 8 hour shift and operates five days a week. The robotic layup process has an average process time of 6.5 minutes, with an SCV of 0.5. On average, once a week the robot goes down and requires a 5 hour maintenance. The UV cure process has an average process time of 8.0 minutes, with an SCV of 1.0. It's reasonably reliable, requiring only about 10 minutes of down time per day. Currently, Jacket is receiving about 288 orders per week, and the average time to turn around an order is about a day and a half. (32 pts)

Based on the data provided by your MIT flunkies:

1. How much WIP would you expect to see in the layup **and** curing processes? (16 pts)
2. What is the primary cause of WIP in layup? Justify your claim. (8 pts)
3. What is the primary cause of WIP in cure? Justify your claim. (8 pts)
4. Please respond to the following (20 pts)
   1. What are the 3 types of buffers. Briefly (1 sentence) describe each. (5 pts)
   2. What is the buffer flexibility corollary? Give 1 example of its implementation. (5 pts)
   3. What is the capacity law? Briefly describe (1 sentence) why systems cannot run at full capacity. (5 pts)
   4. What is the utilization law? (5 pts)
5. Will & Jamison both want coffee before Damon’s 8am class so they can stay awake. Will is going to Dunkin Donuts which has two M/M/1 lines to services their customers. Jamison is going to ChocoLate which services their customers with an M/M/2 configuration with only one queue. [21 pts]
   1. Assuming all else is equal (arrival times, numbers of customers in store, service rates, etc.) who do we expect to get their coffee first and why? [5 pts]
   2. Suppose each system had an arrival rate of 19 customers per hour and a service rate of 20 customers per hour. Compare the WIP, CT, WIPq, & CTq of both systems. Do your results justify or contradict your answer to part (a). Why? [16 pts]