**ISyE 3104 Exam 2 – Part I 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: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Points Summary**

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| --- | --- | --- |
| **Question** | **Points** | **Out of** |
| True/False |  | 14 |
| Multiple Choice |  | 14 |
| Short Answer #1 |  | 25 |
| **Part I Subtotal** |  | **53** |

1. **True/False – Please circle either T for ‘TRUE’ or F for ‘FALSE’. (2 points each)**
   1. T -or- F   The coefficient of variation of the time to process a batch is larger than the coefficient of variation of the time to process a single item
   2. T -or- F   The WIP of a M/M/1/b system is smaller than the WIP of a M/M/1 system with the same arrival and processing rates.
   3. T -or- F   The increase of the potentially good variability always degrades the performance of a production system
   4. T -or- F   The CONWIP system is also known as make to order system
   5. T -or- F   MRP system schedules the release of word based on demand, while a kanban system authorizes the release of work based on system status.
   6. T -or- F   The M/M/m queueing system consist of m independent queues like in most grocery stores where each server has a separate queue.
   7. T -or- F   For a general G/G/1 queueing system, the state of the system can be expressed as a single number n indicating the number of jobs currently in the system.
2. **Multiple Choice - Please circle ONE response.** (2 points each)
3. The \_\_\_\_\_ law is also known as the law of pay me now or pay me later
   1. Variability
   2. Buffering
   3. Conservation of material
   4. Capacity
4. The \_\_\_\_\_ system has a limit on the maximum amount of inventory in the system
   1. push
   2. pull
   3. CONWIP
   4. Both b and c
5. The \_\_\_\_\_ is considered as an example of potentially bad variability
   1. Product variety
   2. Technological Change
   3. Unplanned outages
   4. Demand variability
6. The \_\_\_\_\_ states that if a station increases utilization without making any other changes, average WIP and cycle time will increase in a highly nonlinear fashion
   1. Utilization law
   2. Capacity law
   3. Conservation of material law
   4. Buffering law
7. A M/M/4 system with 11.5 jobs arrivals per hour, and production rate of three jobs per hour, the cycle time is:
   1. 1.824 hours
   2. 2.157 hours
   3. 2.467 hours
   4. 2.800 hours
8. A M/M/1 system with 3.2 jobs arrivals per hour, and production rate of four jobs per hour, the average time spent in the queue is:
   1. 0.5 hour
   2. 1 hour
   3. 2 hours
   4. 4 hours
9. The \_\_\_\_\_ system looks like an open queueing network
   1. Kanban
   2. CONWIP
   3. MRP
   4. Both a and b
10. **Short Answer – Solve the following. Show all of your work. Write neatly and legibly. Place a box around your final answers.** 
    1. Consider a balanced and stable line with moderate variability and large buffer capacities between stations. The line uses an open protocol (i.e., the release rate is predetermined and new jobs are released regardless of the system status.) The raw process time of the line is T0 and the capacity of the line is rb and the utilization is fairly high. What happens to TH and CT when we do the following changes (one at a time.)? Write one sentence to justify your answer. **You will not receive any credit for a correct answer with no justification.** (25 pts)
       1. Reduce the buffer sizes and allow blocking at all stations except station 1. (5 pts)
       2. Reduce the process variability at all stations. (5 pts)
       3. Reduce T0 but keep rb unchanged. (5 pts)
       4. Increase rb but keep T0 unchanged. (5 pts)
       5. Decrease variability in process times and reduce buffer sizes as in (a). Compare to the situation in (a) (5pts)