ISyE 6201: Manufacturing Systems
Instructor: Spyros Reveliotis
Spring 2019
Homework #3
Due date: In class students: Wednesday, 4/3/19
Video students: Saturday, 4/6/19

Reading Assignment:
For this part of the course you are expected to read the material of Chapters 7-10 and 18, in parallel to the in-class developments.
This particular homework pertains especially to Section 7.1, Chapter 8, and Sections 9.1, 9.2, 9.3 and 9.6.
You can also refer to the slides on Factory Physics posted at the course website:
http://www2.isye.gatech.edu/~spyros/courses/IE6201/Fall-08/course_materials.html

Problem Set:
A. Solve the following problems:

• 1, 3 and 5 at the end of Chapter 8 of your textbook.

• 10 at the end of Chapter 9 of your textbook.

• Consider a G/G/1 station operated at 95% of its effective processing capacity. The station is fed with parts at a deterministically paced rate of one part per 10 minutes and the average waiting time experienced by a part before it enters the server is equal to 45 minutes. Use the above information in order to compute the mean and the variance of the part inter-departure times.

• Consider a production line consisting of two single-machine stations. The operational characteristics of these two stations are as follows:

Attribute	**Station 1**	**Station 2**
t_0	11min	11min
c_0	0.5	0.5
MTTF	7hrs	5hrs
MTTR	1.5hrs	0.5hrs
c_r	0.75	0.5

Answer the following questions:
i. Which station is the effective bottleneck of the line?
ii. Can the line sustain a production rate of 35 parts over an eight-hour shift?
iii. Suppose that parts are released to the line in a deterministic manner, with constant inter-release times, and the resulting mean cycle time at Station 1, CT_1, is equal to 2 hours and 7.815 minutes. What is the length of the inter-release intervals?
iv. What is the average WIP waiting for processing at Station 1 under the assumptions of item (iii) above?
v. Provide estimates for the mean and the variance of the part inter-arrival times at Station 2, under the assumptions stated in item (iii) above.

B. Extra Credit (30%)

1. (10%) Prove the formulae provided in Equations 8.5 and 8.6 of your textbook.

2. (20%) Consider a workstation that produces a final product by fastening together two major sub-assemblies. Jobs arriving at this workstation consist of kits containing one unit from each of the two sub-assemblies, and if both parts are in good order, the fastening operation can be performed at an average time of t=2min. However, each of the two parts in a kit can also be defective, with corresponding probabilities p1=0.3 and p2=0.2. A defective part must go through some additional rework that occurs locally and requires an exponentially distributed time; the corresponding processing rates are $r1=0.2min^{-1}$ and $r2=0.1min^{-1}$. Part failures are independent from each other, and in the case that both parts in a kit are defective, the necessary reworks take place simultaneously. Use the above information in order to determine the effective processing capacity of this station. Express your result in product units per hour.

Finally, in your study and your work on the homework, please, remember to consult the document with the errata regarding your textbook, that can be found at: http://www.factoryphysics.net/factoryphysics/Documents/Errata_for_Second_Edition.pdf