Department of Electrical and Computer Engineering
University of Massachusetts Dartmouth

ECE560: Computer Systems Performance Evaluation

Spring 2024

Homework #3

Name: ______________________________

Instructor: Dr. Liudong Xing

ECE560: Computer Systems Performance Evaluation (Spring 2024)
Homework #3

Assigned: February 12, Monday
Due: **February 21, Wednesday, 12:30pm**

Instructions:

1. Print your name on the cover page if you choose to use it or on the first page of your answer sheets.
2. Show all steps of your solution. Answers without justification would subject to a big penalty.
3. If you submit via email, please organize all pages of your answers into one file, name your file using **"HW3-your last name.pdf or doc"** (e.g., HW3-Xing.pdf), and submit it to lxing@umassd.edu
4. Relevant lecture notes : **Lectures #6 & #7**

Problems:

1. Inquiries of the Poisson Portal interactive query system arrive at the central computer in a *Poisson* pattern at an average rate of 13 inquiries per minute (i.e., with parameter λ=13/minute).
   a. What is the mean time between successive inquiries?
   b. What is the probability that the time interval between the next two inquiries will be no more than 8 seconds?
   c. More than 11 seconds?
   d. Between 8 seconds (not included) and 11 seconds (included) seconds?

2. **Problem 41 (Page97) (a)-(e) in Chapter 2 of the Textbook by Allen (Copied Below)**

41. [20] Dusty Page, a librarian at Hard Core Computer (makers of solid state memory), tripped over the discrete random variables X and Y when he stepped from his office. These random variables have the joint probability mass function shown in the table below. Thus, X assumes the values 0 and 1, and Y assumes the values 0, 1, and 2.

X \ Y	0	1	2
0	1/8	1/4	1/8
1	0	1/8	3/8

Help Dusty out by doing or answering the following:

(a) Find the marginal probability mass functions p_X and p_Y.

(b) Find the conditional probability mass function of X, given that $Y = 2$.

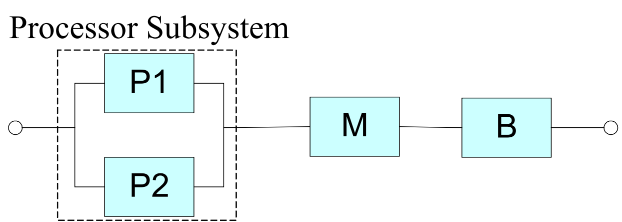
(c) Are X and Y independent random variables? Why?

(d) Calculate $E[X], E[Y]$, Var$[X]$, and Var$[Y]$.

(e) Find the probability mass function for $Z = X + Y$.

[HM30] Suppose X and Y are independent random variables each

3. A computer system consists of two processors and a shared memory communicating over a shared bus. The computer system is operational as long as at least one of the two processors can communicate with the memory over the bus. As shown in the following figure, the two processors P1 and P2 constitute the processor subsystem and they have the same exponential time-to-failure with a mean of 8000 hours. The memory M has the exponential time-to-failure with a mean of 8000 hours. The bus B has the exponential time-to-failure with a mean of 10000 hours. Each component of the computer system fails independently.



a. What is the distribution function F for describing the time to failure of the processor subsystem?
b. What is the probability that the processor subsystem will not fail during 10000 hours of continuous operation?
c. What is the probability that the entire computer system will not fail during 10000 hours of continuous operation?