Arab Academy of Science and Technology and Maritime Transport
Computer Engineering Department
Computing Algorithms -CC 412 - 12th week Exam – Take Home Exam
Date: December. 14th , 2024 - Due date: 22.00, December 24th , 2024

Answer is due by 22.00, Tuesday, December 24th 2024 via Google classroom. This take-home exam counts *10%* towards your final grade for this course. Your grade for the exam will be based on whether you answer all parts of the question, a reference to the required reading, and class discussion. Submit a pdf file for handwritten material.

Question: Write a complete computer algorithm that simulates the ACPC grading system server with the following specifications: -

- The server consists of 10 different computers.
- Each computer has a certain amount of time it can give. The contest problems codes arrive at random intervals and attempt to use one of the 10 computers:
- If a computer is available, the problem is immediately allowed to use it.
- Each problem requires a certain service time (random number based on exponential distribution function).
- If all computers are currently busy, the new arrival problem waits in a Queue until one of the computers becomes available.
- The time intervals between two problems have an exponential probability density function with average time = ʎ secs, which describes the frequency of tasks arriving.

When solving this problem, you will need to do the following:

- ✓ Create exponentially distributed random numbers by using the uniform random function "rand ()". You will use this function to generate the inter-arrival time for each new task and to calculate the average service time/task.
- ✓ Use of queue,

It is required to doo the following:

Calculate the average delay time, waiting time, average queue length when you run your simulator for 5 hours.

These "**interarrival**" **times** and service times in this problem are typically exponentially distributed. If the mean **interarrival time** is $1/\lambda$ (so λ is the mean arrival rate per unit **time**), then the variance will be $1/\lambda^2$ (and the standard deviation will be $1/\lambda$).

1. **Part I:** You must submit an algorithm showing the detailed design that matches the above specifications.

2. **Part II:** You must submit a complete implementation of your design using **C/C++, Java, or Python**. Your implementation must be carefully tested against the above specifications. Assume that:

   Average inter-arrival time = 35 sec.
   Average service time = 42 sec.