

King Saud University

College of Computer and Information Sciences

Computer Science Department

CSC412: Modeling and Simulation

Midterm Exam

1. Define and discuss the meanings of the following simulation terms
 - a. Model
 - b. Environment
 - c. System
 - d. Model
 - e. Computer simulation
 - f. Continuous model
 - g. Discrete event model
 - h. Model accuracy
 - i. Model performance
 - j. Quality of a random number
2. Consider a random variable X which takes on values 0 and 1 with probability 0.4 and 0.6, respectively.
 - a. Determine the mean and variance of X .
 - b. Plot the probability density function (pdf)
 - c. Plot the probability distribution function (PDF) of X .
3. Sketch a flowchart for a discrete-event simulation model
4. Write a program that models a single server queue with deterministic interarrival and service times. Give its output and discuss the results.
5. Give your expertise about how you could model and simulate traffic in Riyadh (only the main roads around KSU). Discuss the model performance and accuracy concerns. Simulate the model and give its output during rush hours.
6. Consider the following system

A single-server queueing system from time = 0 to time = 20 sec. Arrivals and service times are:

- Customer #1 arrives at $t = 1$ second and requires 2 seconds of service time
- Customer #2 arrives at $t = 4$ second and requires 5 seconds of service time
- Customer #3 arrives at $t = 8$ seconds and requires 15 seconds of service time
- Customer #4 arrives at $t = 17$ seconds and requires 2 seconds of service time

Solve for system throughput (X), total busy time (B), mean service time (T_s), utilization (U), mean system time (delay in system) (W), and mean number in the system (L). Show your work to receive full credit.

7. Build a population model for the city of Riyadh and compare it with some real data (5 years). Calculate the Error. Give an estimation for Riyadh population in 2030.
8. The CFD problem given during lecture.
9. Use finite difference to model flow through the following structure:

A curved pipe of diameter $D = 0.3$ meters. The inlet pressure is 2 Pa and the flow rate at the inlet is $2.0 \text{ m}^3/\text{min}$