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UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS
FOURTH YEAR FIRST SEMESTER

FOR THE DEGREE IN

(INFORMATION TECHNOLOGY)

COURSE CODE: BIT 415

COURSE TITLE: SIMULATION AND MODELING

DATE: 19/12/2023   TIME: 2.00 P.M- 4.00 P.M

INSTRUCTIONS

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

a. What is system model? Discuss different system perspectives that can be represented in a model. **[5 marks]**

b. Outline the three main roles of graphical models in system modeling. **[3 marks]**

c. **Explain** any TWO real world problems in business where simulation is applied and their solution methods. **[4 marks]**

d. What are the main reasons of analyzing a system during system modeling? **[3 marks]**

e. Explain why differential equations are important when studying continuous systems simulation **[2 marks]**

f. Explain the meaning of Monte Carlo simulation pointing out its key characteristics, advantage and disadvantages. **[4 marks]**

g. Explain model building, verification and model Validation as distinct processes. **[5 marks]**

h. What is the meaning of network of queues and how system performance in network system can be measured? **[4 marks]**

QUESTION TWO [20 MARKS]

a. System is not a randomly arranged set. Explain. **[2 marks]**

b. Explain why probability theory of interest to performance modeling of information systems? **[2 mark]**

c. Discuss any three Important features (or concepts) of a business system. **[6 marks]**

d. Discuss various classification of mathematical models **[4 marks]**

e. Discuss the **ANY THREE** principles used in modelling process. In each case provide a real life justification. **[6 marks]**

QUESTION THREE [20 MARKS]

a. Explain the meaning of a continuous system simulation and model. **[2 marks]**

b. Explain THREE situations that you will prefer simulation and THREE situations in which you will not prefer simulation as an appropriate tool. **[6 marks]**

c. Explain how simulation and modeling is applied in the following areas. **[6 marks]**
   i. Manufacturing
   ii. Business process
   iii. Healthcare

d. Discuss various steps followed during a simulation study? **[6 marks]**

QUESTION FOUR [20 MARKS]

a. State the key features of Markov Chain and its application areas [4 marks]

b. Naylor and Finger proposed THREE step approach for validation process of a simulated model. Discuss these steps. [6 marks]

c. Explain briefly how the following methods are used to analyze simulation results.

   i. Estimation Methods [2 marks]

   ii. Simulation Run Statistics [2 marks]

   iii. Elimination of Initial Bias [2 marks]

d. Explain how you can use the following software in simulation process.

   i. Simulation in GPSS [2 marks]
   ii. SSF Model [2 marks]

QUESTION FIVE [20 MARKS]

a. What is a queuing system? What is the need of studying queuing systems? [3 marks]

b. What are the various type of queuing systems and how are the types arrived at? [4 marks]

c. Explain A / B / c / D / N / K Kendall's notationas used for parallel server systems [3 marks]

d. The average response time for http requests at a web server is 2 minutes. The system busy time was measured to be 50 seconds during a one minute observation interval. Use an M/M/1 model for the system to determine the following.

i. What is the average service time per transaction [4 marks]

ii. What is the probability there are more than one http request in the system. [2 marks]

iii. On average, how many requests are in the system [2 marks]

iv. What is the average time a request spends in the queue? [2 marks]