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| **1.** | **a)** | What is simulation? What are the necessity of simulation in research? |  |
|  | **b)** | What is the procedure to conduct a simulation? |  |
|  | **c)** | What do you mean by system, state of a system and simulation? Give examples to explain these terms. |  |

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| **2.** | **a)** | When a simulation called Discrete-Event Simulation or Continuous-Event Simulation? |  |
|  | **b)** | Explain a single-server queue and its different states |  |
|  | **c)** | Write some advantages and disadvantages of simulation. |  |

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| **3.** | **a)** | If notation ti, Ai, Si, Di, Ci and ei are used to explain a single-server queue for time of arrival of *i*th customer, interarrival time between (*i*-1)st and *i*th customers, service-time requirement of *i*th customer, delay in queue of *i*th customer, time *i*th customer completes service and departs and time of occurrence of the *j*th event respectively then write their relationships and draw the system in a diagram. |  |
|  | **b)** | Suppose virtual customers are arrived with the following inter-arrival time and service time  A1 = 0.4, S1 = 2.0 A2 = 1.6, S2 = 0.7 A3 = 0.4, S3 = 0.3  A4 = 1.1, S4 = 1.1 A5 = 0.2, A6 = 1.4, A7= 1.3  If Q(t) is the queue length at time t and B(t) is the busy function against t. Construct the function queue length Q(t) and server business B(t). |  |
|  | **c)** | What is Time-Average Queue Length? Calculate it from the above example. |  |

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| **4.** | **a)** | When and why a probability distribution associated with simulation? Give examples of the use of discrete and continuous probability distribution in simulation. |  |
|  | **b)** | Explain Different Kinds of Queuing Systems along with their parameters. State and explain Little’s law and utilization law in queuing system. |  |
|  | **c)** | Write the probability function of exponential distribution with it mean and variance. Why is this distribution called memory-less distribution? |  |

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| **5.** | **a)** | Define Negative Binomial Distribution and geometric distribution. Write the application of these distribution in simulation. |  |
|  | **b)** | Chi-square Goodness-of-fit Test is widely use after a simulation performed, what are the process of conduction this test and why do researchers use this test? |  |
|  | **c)** | What are the application of Q-Q and P-P plot? Construct a Q-Q plots for the inter arrival time of customers 10, 12,18 22 in seconds. |  |

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| **6.** | **a)** | Briefly explain the terms: Trace-driven simulation, Linear Congruential Generators |  |
|  | **b)** | What is uniform test and correlation test of random number? |  |
|  | **c)** | Write the process of inverse transform method to generate random numbers? Write the problems with the inverse transform method |  |

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| **7.** | **a)** | What is Monte Curlo simulation? Explain briefly three basic types of parameters to describe the distribution. |  |
|  | **b)** | Explain Method of moments and *Maximum Likelihood Estimator.* |  |
|  | **c)** | Consider an M/M/1 queuing system with an inter arrival rate 0.04 and service rate 0.7. Compute the system load and show that the system is stable or not? |  |