Modeling & Simulation

Assignment # 1

Assignment Submission Date: 23rd November 2022

(Assignment should be written on A4 papers)

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1. Melanie is the manager of the Clean Machine car wash and has gathered the following information. Customers arrive at a rate of nine per hour according to a Poisson distribution. The car washer can service an average of eleven cars per hour with service times described by an exponential distribution. Melanie is concerned about the number of customers waiting in line. She has asked you to calculate the following system characteristics:
2. Average system utilization
3. Average number of customers in the system
4. Average number of customers waiting in line
5. Melanie realizes that how long the customer must wait is also very important. She is also concerned about customers balking when the waiting line is too long. Using the arrival and service rates in Problem 1, she wants you to calculate the following system characteristics:
6. The average time a customer spends in the system
7. The average time a customer spends waiting in line
8. The probability of having more than three customers in the system
9. The probability of having more than four customers in the system
10. Arrivals to a self-service gasoline pump with one filling station occur in a Poisson fashion at the rate of 1 per hour. Service time has distribution that averages 1 per 45 minutes. Calculate the operational characteristics?
11. Sid Das cabinet-making shop, in Memphis, has one technician that drills holes for the installation of hinges. The technician needs setting up for each order of cabinets. The orders appear to follow the Poisson distribution, averaging 3 per 8-hour day. There is a single technician for setting these machines. His service times are exponential, averaging 2 hours each. Calculate all operational characteristics.
12. Name serval entities, attributes of entities, activities, events and state variables for following systems also describe what you think would be the most effective way to study each of the following systems, in terms of possibilities and discuss why?
13. A small section of an existing factory.
14. An emergency room in an existing hospital.
15. A pizza delivery operation.
16. The shuttle bus operation foe a rental car agency at an airport
17. A grocery store.
18. Verify following relations for single server queue.
19. L = Lq + 1 – P0
20. L = Lq + P
21. Consider the ticketing system with one ticketing counter is simulated. The system consists of those customers in waiting line plus the one checking out. The simulation analyst desires to estimate mean response time, mean proportion of customers who spend 5 or more minutes in the system and number of departures up to the current simulation time. Design a table using event scheduling algorithm for the given IAT and ST.

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| --- | --- | --- | --- | --- | --- | --- |
| IAT | 2 | 3 | 5 | 3 | 5 | 6 |
| ST | 1 | 6 | 4 | 4 | 6 | 4 |

1. Consider the hospital mgt system with one window is simulated. The system consists of those customers in waiting line plus the one checking out. A stopping time of 45 minutes is set for the model. The simulation analyst desires to estimate mean response time, mean proportion of customers who spend 5 or more minutes in the system and number of departures up to the current simulation time. Design a table using event scheduling algorithm for the given IAT and ST.

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| --- | --- | --- | --- | --- | --- | --- |
| IAT | 10 | 5 | 6 | 10 | 15 | 10 |
| ST | 12 | 16 | 13 | 12 | 16 | 12 |

1. Consider the truck loading system with one loading machine is simulated. The system consists of those trucks that are in waiting line plus the one checking out. The simulation analyst desires to estimate mean response time, mean proportion of trucks that spends 10 or more minutes in the system and number of departures up to the current simulation time. Design a table using event scheduling algorithm for the given IAT and ST.

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| IAT | 6 | 11 | 6 | 6 | 10 | 6 | 11 | 11 |
| ST | 13 | 13 | 13 | 17 | 16 | 13 | 13 | 17 |