Modeling & Simulation

Assignment # 1

Assignment Submission Date: Section A: 13 Nov 2019

Section B: 14 Nov 2019

(Assignment should be written on A4 papers)

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1. Describe what you think would be the most effective way to study each of the following systems, in terms of possibilities and discuss why. Also name serval entities, attributes, activities, events and state variables for following systems
2. A small section of an existing factory.
3. An emergency room in an existing hospital.
4. A pizza delivery operation.
5. The shuttle bus operation foe a rental car agency at an airport
6. A grocery store.
7. Verify following relations for single server queue.
8. L = Lq + 1 – P0
9. L = Lq + P
10. Melanie is the manager of the Clean Machine car wash and has gathered the following information. Customers arrive at a rate of eight per hour according to a Poisson distribution. The car washer can service an average of ten 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:
11. Average system utilization
12. Average number of customers in the system
13. Average number of customers waiting in line
14. 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 3, she wants you to calculate the following system characteristics:
15. The average time a customer spends in the system
16. The average time a customer spends waiting in line
17. The probability of having more than three customers in the system
18. The probability of having more than four customers in the system
19. Patients arrive for a physical examination according to Poisson process at the rate 1 per hour. Treatment for the patient is completed at the rate of 1 per 45 minutes. Computer the average number of delayed patients Lq for this system. If 2 attenders are available compare the values.
20. Arrivals to a self-service gasoline pump with two filling stations occur in a Poisson fashion at the rate 12 per hour. Service time has distribution that averages 4 minutes. Calculate the operational characteristics?
21. Classic car care has 3 workers who washes car in four steps method – soap, rinse, dry and vacuum. The time to complete each step is exponentially distributed with mean 9 minutes. Every car goes through every step before another car begins the process. On the average, one car every 45 minutes arrives for a wash job, according to a Poisson process. What is the average time a car waits to begin the wash job? What is the average number of cars in the car wash system? What is the average time required to wash a car? (Consider it a simple M/M/c problem)
22. 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 | 1 | 5 | 6 |
| ST | 1 | 6 | 4 | 2 | 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 | 5 | 10 | 15 | 10 |
| ST | 12 | 16 | 12 | 12 | 16 | 12 |