

M.E. PRODUCTION ENGINEERING**FIRST YEAR****FIRST SEMESTER EXAM 2025****MODELLING OF SYSTEMS & SIMULATION**

T: 3 Hrs.

FM:100

Ans. any 2 Q-s.

1. Consider a banking system involving 2 inside tellers & 2 drive-in tellers. Arrivals to the banking system are either for the drive-in tellers or for the inside tellers. The time between arrivals to the drive-in tellers is exponentially distributed with a mean of 0.75 mins. The drive-in tellers have limited waiting space. Queue space is available for only 3 cars waiting for the 1-st teller & 4 cars waiting for the 2-nd teller. The 1-st drive-in teller service time is normally distributed with a mean of 0.5 mins. & Std. deviation of 0.25 mins. The 2-nd drive-in teller service time is uniformly distributed betn. 0.2 & 1 mins. If a car arrives when the queue of both drive-in tellers are full, the customer balks & seeks service from 1 of the inside bank tellers. However, the inside bank system opens 1 hr. after the drive-in bank. Customers who directly seek the service of inside tellers arrive through a different arrival process with the time betn. arrivals exponentially distributed with a mean of 0.5 mins. However, they join the same queue as the balkers from the drive-in portion. A single queue is used for both inside tellers. A maximum of 7 customers can wait in this single queue. Customers who arrive when there are 7 in the inside queue balk & do not seek banking service. The service times for the 2 inside tellers are triangularly distributed betn. 0.1 & 1.2 mins., with a mode of 0.4 mins. Simulate the operation of the bank for an 8 hr. period. 50
2. Cargo arrives at an air terminal in unit loads at the rate of 2 unit loads per minute. At the freight terminal, there is no fixed schedule, & planes take off as soon as they can be loaded to capacity. 2 types of planes are available for transporting cargo. There are 3 planes with a capacity of 80 unit loads & 2 planes with a capacity of 140 unit loads. The round trip time for any plane is normally distributed with a mean of 3 hrs., a s.d. of 1 Hr., & minm. & maxm. times of 2 & 4 hrs. respectively. The loading policy of the terminal manager is to employ smaller planes whenever possible. Only when 140 unit loads are available will a plane of type 2 be employed. Develop a Visual SLAM Network to model the system to estimate the no. of unit loads waiting & the utilization of the 2 types of planes over a 100 hr. period. Assume, at 1-st, that, the loading time of planes is negligible. Embellish the model to include a 1 min. per unit loading time. 50

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3. Entities are generated at a node whose level is START. 1-st entity is to be generated at time 6. Thereafter the time betn. entry arrivals is exponentially distributed with a mean of 2 time units. An unlimited no. of entities can be generated at node START. Entities are routed to QUEUE node Q1 if gate G1 is open. The time to reach node Q1 = The capacity of the queue which is 5 minus the current no. of entities in Q1. Entities that balk from Q1 leave the system. Initially, there are no entities at Q1 & file 1 is used to store entities waiting at Q1. 2 servers process entities waiting at Q1. Processing time of these servers is normally distributed with a mean of 3 & as.d. of 1. After service, an entity leaves the system. If an entity's time in the system is greater than 10, gate G1 is closed. Gate G1 is open when an entity spends less than 2 time units in the system or when an arrival finds no one waiting at queue node Q1. It is desired to collect the time betn. departures for all entities that have arrived to the system. Draw the visual SLAM network of the processing of entities as described above.