Ref. No.: Ex/PG/ProdE/T/115B/2024

M.E. PRODUCTION ENGINEERING
FIRST YEAR
FIRST SEMESTER EXAM 2024

SIMULATION THEORY AND APPLICATIONS (PM)

Time : 3 Hours | Full Marks : 100

Ans. **any 2** Q-s.

1. A machine tool processes two different types of parts. The time between arrivals of Type-1 part is triangularly distributed with a mode of 30 minutes, a minimum of 20 minutes and a maximum of 50 minutes. The interarrival time of Type-2 parts is a sample from a triangular distribution with a mode of 50 minutes, a minimum of 35 minutes, and a maximum of 60 minutes. Processing time for Type-1 part is exponentially distributed with a mean of 20 minutes. For Type-2 parts, processing time is a sample from a uniform distribution, with a minimum of 15 minutes and a maximum of 20 minutes. Processing time includes an inspection of the completed part .15% of the parts fail inspection and return to the end of the queue of parts awaiting processing. Assume that the parts which fail inspection have a rework time equal to 90% of the previous processing time. Develop a Visual SLAM network to collect statistics on the time spent in the system by a part and the utilization of the machines. Simulate this system for 2400 minutes. 50

2. Develop a SLAM network model for the following situation. A machine shop contains two drills, one straightener and a finishing area. Drilling time is normally distributed with a mean of 10 minutes and a standard deviation of one minute. For those parts that need to be straightened, it takes 15 time units on the average, and this time is exponentially distributed. To perform the finishing operations on a part takes 5 mins. and only 1 part can be finished at a time.

The machine shop processes 2 types of parts. Type 1 parts arrive every 30 minutes and it takes 2 mins. for the arriving part to be routed to the drill area. Type 1 parts require the drilling operation, straightening and finishing. Type 2 parts arrive every 20 mins. and require only drilling and finishing. The time to route a Type 2 part from its arrival to the drilling area is 10 mins. Assume no time delays between drilling, straightening and finsihing operations. Assume operators are always available if a machine is available. The network is to be used to obtain information on throughput of parts through the machine shop and utilization of the drills, straightener and finishing area.

Throughput by each part type is also desired. A histogram of the time for each part type to be processed through the machine area is to be obtained. The initial condition of the machine shop is that it is empty.

Embellishment :

Estimate the expected time in the system for each part type under the assumption that there are 20 drills, 10 straighteners and 15 finishing operators. Estimate the variance of the time in the system for ech part type. 50

3. Cargo arrives at an air terminal in unit loads at the rate of two unit loads per minute. At the freight terminal there is no fixed schedule, and planes take off as soon as they can be loaded to capacity. Two types of planes are available for transporting cargo. There are three planes with a capacity of 80 unit loads and two planes with a capacity of 140 unit loads. The round trip time for any plane is normally distributed with a mean of 3 hours, a standard deviation of 1 hour and minimum and maximum times of 2 and 4 hours 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 SLAM II network to model this system to estimate the number of unit loads waiting and the utilization of the two types of planes over a 100 hour period. Assume at first that the loading time of planes is negligible. Embellish the model to include a one minute per unit loading time. 50