GX575

OLLSCOIL NA hÉIREANN, GAILLIMH

NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER II EXAMINATIONS 2000-2001

3rd INDUSTRIAL ENGINEERING AND INFORMATION SYSTEMS

SYSTEMS SIMULATION IE 324

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Instructions:
Time Allowed: 2 Hours.
Attempt: 3 Questions. Show all your work clearly. All Questions carry equal marks. Random Variates from the Uniform Distribution on [0,1] included. Maths Tables and Cambridge Elementary Statistical Tables Supplied.

Question		Marks
Q.1	**Manual Simulation**	**33.33***

A bill paying area in the local electricity supply shop has two payment booths. Customers arrive to the area, wait for service, pay their bills and depart the premises. Customers arrive at a rate of 18 per hour. If the tellers are busy, customers wait in a single queue with a maximum capacity of 4 places. If the queue is full on arrival then customers depart the premises. The mean service time at booth number 1 is 5 minutes. The variance of this service time is 2.25. The mean service time at booth number 2 is 6 minutes. The standard deviation of this service time is 0.5. Customers are served on a first come first served basis (FCFS).

Manually simulate the above system for the arrival and departure of 10 customers. Select appropriate distributions for interarrival times and service times. **Note:** Clearly identify the sequence of selection of random numbers uniformly distributed on [0,1] from the table included.

Q.2 Write short notes on **four** of the following: **8.33*x4**

- Steps in computer simulation
- The benefits of computer simulation in manufacturing
- Manufacturing issues that simulation is used to address
- Verification, validation and credibility of computer simulation models
- How simulation experiments differ from other conventional statistical experiments.
- Variance reduction and its importance in computer simulation

Q.3 (a) Write a short note on the Exponential distribution in the context of computer simulation **8**

(b) What is the relationship between the Exponential, Erlang and Gamma distributions? **5**

(c) The number of arrivals at a bank can be described by a Poisson distribution with a mean (rate) of 4 per hour. Sample this distribution during a period of 1.6 hours. Use the midsquare technique with a seed value of .4192 to generate random numbers. **20.33***

Q.4 a) Describe the following modeling components in MicroSaint: **10**

- Decision nodes
- Beginning effect
- Ending effect
- Snapshots
- Scenarios

b) **Airline Check-in Desk.** An airline check-in area has two desks with one check-in person at each desk. Passengers arrive to the area, wait for service by a check-in person, are checked-in and then depart to the departures hall. Passengers arriving to the system when the tellers are busy wait in a single queue in front of the desks. Passengers are served on a first come first served (FCFS) basis. If both check-in people are available at the same time then the next customer is served by check-in person number 2. **23.33***

Develop an event-based model of this scenario. Use verbal descriptions (pseudocode) and flowcharts where appropriate to illustrate your answer.

Q.5 (a) Discuss some possible sources of error when simulation output is analyzed. **8.33***

(b) The following simulation data was collected for the purpose of determining whether the expected waiting time in a proposed service facility is less than 1.90 minutes. Each data point is the average wait for 1000 simulated customers: **25**

1.56, 1.60, 1.89, 2.14, 1.99, 1.81, 1.59, 1.70, 2.19, 1.99

i. What can you conclude from the data?

ii. Estimate the number of additional batch means that you would have to collect to obtain a 90% confidence interval with a half width of 0.1 units.

iii. Assuming that the preceding data was collected using the method of one long run and that no batches were discarded, is there anything about this data that causes you to be concerned about the validity of your conclusions?