NATIONAL UNIVERISTY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCES
COMPUTER SCIENCE DEPARTMENT
MAY 2001 EXAMINATIONS

SUBJECT: **Simulation and modelling**
CODE: SCS2204

INSTRUCTIONS TO CANDIDATES
1.   This question paper consists of six (6) questions answer any four (4)
2.   Special requirements
       Statistical Book of tables
       Scientific calculators

                                                3 Hours

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1. (a) Computer simulation and modeling is amongst various other decision support tools, briefly discuss the following tools as used in decision support. Compare each tool with simulation and modeling.

        i.   Analytical methods
        ii. Spreadsheets   -   [10]

    (b) Draw up the steps followed in a simulation study.   [15]

2.   (a)   When is simulation the appropriate tool   [5]
     (b)   Give three advantages and two disadvantages of simulation modelling.   [10]
     (c)   Discuss any four areas of application of computer simulation modelling   [10]

3. (a) Explain the characteristics of queuing models and describe Kendall's notation for representing queuing models.   [10]

   (b)   A soft service store employs one cashier at its counter. 17 customers arrive on an average every 10 minutes. The cashier can service 10 customers in 5 minutes. Assuming poison distribution for arrival and exponential distribution for service rate, find:

          (i)   average number of customers in the system
          (ii)   average number of customers in queue *(average queue length)*
          (iii)   average time a customer spends in the system
          (iv)   average time a customer waits before being served
          (v)   probability of there being no customers in the system   [15]

4. A Newspaper vendor buys newspapers for 33 cents each and sells them for 50 cents each. Newspapers not sold at the end of the day are sold as scrap for 5 cents each. Newspapers can be purchased in bundles of 10. Thus, the paper seller can buy 50, 60 and so on. There three types of news days, "Good", "Fair", and "Poor", with probabilities of 0.35,0.45, and 0.20 respectively. The distribution of papers demanded on each of these days is given in the table below.

Determine the optimal number of newspapers the vendor must purchase by simulating demands for 5 days and recording profits from sales each day. [25]

Demand	Demand Probability Distribution		
	Good	Fair	Poor
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

5. (a) What are the desirable properties of random numbers? How would you ensure that a given series of numbers is random? Explain any two tests you have specified [10]

(b) A sequence of 40 numbers is given below:

0.41 0.68 0.89 0.94 0.74 0.91 0.55 0.62 0.36 0.27
0.19 0.72 0.75 0.08 0.54 0.02 0.01 0.36 0.16 0.28
0.18 0.01 0.95 0.69 0.18 0.47 0.23 0.32 0.82 0.53
0.31 0.42 0.73 0.04 0.83 0.45 0.13 0.57 0.63 0.29

Determine whether the hypothesis of indepence can be rejected where $Z_{\alpha/2} = 1.96$
    (i) Based on runs up and runs down
    (ii) Based on runs below and above the mean [12]

(c) What is the importance of "design of simulation experiments"? [3]

6. The time required for the transmission of a message (in minutes) is sampled electronically at a communications center. The last 30 values in the sample are as follows:

7.936 4.612 2.407 4.278 5.132 4.599 5.224 2.003 1.857 2.696
5.259 7.563 3.973 6.908 5.002 6.212 2.759 7.172 6.513 3.326
8.761 4.502 6.188 2.566 5.515 3.785 3.742 4.682 4.346 5.359

How are the transmission times distributed? Develop and test an appropriate model. [25]

END OF QUESTION PAPER