

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
MAY EXAMINATIONS 2009

SUBJECT: SIMULATION AND MODELLING
CODE: SCS 4108

INSTRUCTIONS TO CANDIDATES

Answer all questions from section A and any 2 from section B.
Each question carries 25 marks
You may use scientific calculators
Time: 3 hours

SECTION A

Question One

- a) When is simulation an appropriate tool? [5]
b) Distinguish between
 i. Static simulation model and dynamic simulation model
 ii. Deterministic simulation model and stochastic simulation model [5]
c) With the aid of a flow diagram explain the steps involved in a simulation study. [15]

Question Two

- (a) Define the following:
 i. Future Event List (FEL) [2]
 ii. Event Notice [2]
 iii. Simulation Clock [2]
 iv. Activity [2]
 v. State [2]
(b) Discuss any two areas of application of computer simulation modelling. [5]
(c) Give three advantages and two disadvantages of simulation modelling. [5]
(d) Use the linear congruential method to generate a sequence of three two-digit random numbers.
 Let $X_0 = 27$ $a=8$ $c=47$ and $m=100$ [5]

SECTION B

Question Three

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 are 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

Question Four

a) There are three machines and one mechanic. When any one of the machines is broken down the mechanic repairs it. After repair the machine runs until it breaks down again. The company involved, wants to determine the average waiting time of the machine before it is repaired and the percentage of time the mechanic is idle. The objective of such an exercise may be to determine if the mechanic could be put in charge of a fourth machine (or conversely there is a need for a second mechanic). Specify a model using an activity cycle diagram. [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 independence can be rejected where $\alpha=0.05$

- (i) Based on runs up and runs down
- (ii) Based on runs above and runs below the mean [15]

Question Five

a) Use the Kolmogorov-Smirnov test with a level of significance of 0.05 to perform a test for uniformity for the following five auto generated numbers

0.44 0.81 0.14 0.05 0.93 [10]

b) Consider a single-Machine job shop that processes two distinct products (or part types). Type 1 parts arrive every 10 minutes and require 4 minutes to process on the machine. Type 2 parts begin to arrive at time 5 and continue arriving every 6 minutes thereafter. Each type 2 part requires 3 minutes to process.

Draw or write the **Model File program** and the **Experiment file program used in SIMAN V**. Given that you need to determine the number of parts of each type that are processed in one 8-hour shift. [15]

END OF QUESTION PAPER