

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
DECEMBER EXAMINATIONS 2004

SUBJECT: SIMULATION AND MODELLING
CODE: SCS 4108

INSTRUCTIONS TO CANDIDATES:

This Examination paper consists of seven questions (7)
All questions carry equal marks
Answer **any FIVE (5)** questions

TIME: 3HOURS

QUESTION ONE

Use the chi-square test with $\alpha = 0,05$ to test whether the data shown below are uniformly distributed. In the test use 10 intervals of equal length, namely $[0, 0.1], [0.1, 0.2], \dots, [0.9, 1.0]$. Given that $X^2_{0.05, 9} = 16,9$

0.34 0.90 0.25 0.89 0.87 0.44 0.12 0.21 0.46 0.67
0.83 0.76 0.79 0.64 0.70 0.81 0.94 0.74 0.22 0.74
0.96 0.99 0.77 0.67 0.56 0.41 0.52 0.73 0.99 0.02
0.47 0.30 0.17 0.82 0.56 0.05 0.45 0.31 0.78 0.05
0.79 0.71 0.23 0.19 0.82 0.93 0.65 0.37 0.39 0.42
0.99 0.17 0.99 0.46 0.05 0.66 0.10 0.42 0.18 0.49
0.37 0.51 0.54 0.01 0.81 0.28 0.69 0.34 0.75 0.49
0.72 0.43 0.56 0.97 0.30 0.94 0.96 0.58 0.73 0.05
0.06 0.39 0.84 0.24 0.40 0.64 0.40 0.19 0.79 0.62
0.18 0.26 0.97 0.88 0.64 0.47 0.60 0.11 0.29 0.78 [20]

QUESTION TWO

- a) Outline the disadvantages of simulation [3]
- b) What do you understand by the term *system*? [1]
- c) Describe the components of a system. [5]
- d) Distinguish between *deterministic* and *stochastic* models. [4]
- e) Briefly discuss one method of random number generation. [7]

QUESTION THREE

- a) Draw a flow diagram to show service-just completed. [5]
- b) Briefly describe the characteristics of queuing systems. [10]

- c) Use the linear congruential method to generate a sequence of three two-digit random integers. Let $X_0 = 27$, $a=8$, $c=47$, and $m=100$. [5]

QUESTION FOUR

- a) The sequence of numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use the Kolmogorov-Smirnov test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval $[0,1]$ can be rejected. [10]
- b) Outline the four steps in the development of a useful model of input data. [8]
- c) Briefly explain the following terms:
- i. Event [1]
 - ii. Activity [1]

QUESTION FIVE

- a) Discuss two tests for Random Numbers [4]
- b) When do we use the terms *endogenous* and *exogenous* in simulation systems? [4]
- c) Distinguish between a *static* simulation model and a *dynamic* simulation model. [6]
- d) Briefly discuss any two steps in a simulation study [6]

QUESTION SIX

A small grocery has only one till. Customers arrive at the till at random from 1 to 10 minutes apart. The service distributions are shown in table 2.1. The random digits are given in table 2.2.

Table 2.1

Service Time (min)	1	2	3	4	5	6
Probability	0.05	0.1	0.2	0.3	0.25	0.10

Table 2.2

Customer	1	2	3	4	5	6	7	8	9	10
Random Digits for Arrival	-	26	98	90	26	42	74	80	68	22
Random Digits for Service	95	21	51	92	89	38	13	61	50	49

- i. Develop the simulation table and analysis for customers. [11]
- ii. What is the average waiting time for a customer? [3]

- iii. What is the utilization of the teller? [3]
iv. What is the average time a customer spends in the system? [3]

QUESTION SEVEN

- a) Outline how simulation is used in business system improvement. [10]
b) Discuss the limitations of simulation. [4]
c) Describe three types of simulation modeling methods. [6]

END OF QUESTION PAPER

GOOD LUCK!