

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**FACULTY OF APPLIED SCIENCE**  
**COMPUTER SCIENCE DEPARTMENT**  
**JULY SUPPLEMENTARY EXAMINATIONS 2005**

**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: 3 HOURS**

**QUESTION ONE**

- a) Simulation Languages nowadays provide many capabilities to aid the modeller in the difficult task of debugging and verification. Highlight some of these capabilities. [10]
- b) Discuss the trends in simulation software. [10]

**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) Outline how simulation is used in Business system improvement. [10]
- c) Discuss one method of random number generation. [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) For pseudo-random number generators to be useful, they should produce sequences over  $U[0,1]$  that are **uniform** and **independent**. Informally state what each of these properties means. Give and justify an example of a sequence that is uniform over  $U[0,1]$  but not independent, and a sequence that appears to be independent but not uniform over  $U[0,1]$ . [10]
- b) A proposed random number generator produced the following sequence of values over  $U[0,1]$ :

0.3 0.3 0.8 0.1 0.9 0.5

Using the Kolmogorov-Smirnov test, determine whether or not this sequence is uniform over  $U[0,1]$  with a level of significance of  $\alpha = 0.05$ . Be specific and show all work in the process. [10]

**QUESTION SEVEN**

- a) Discuss the limitations of simulation. [4]
- b) Describe three types of simulation modeling methods. [6]
- c) Briefly describe the characteristics of queuing systems. [10]

**END OF QUESTION PAPER**