

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**FACULTY OF APPLIED SCIENCE**  
**COMPUTER SCIENCE DEPARTMENT**  
**AUGUST Supplementary EXAMINATIONS 2004**

**SUBJECT:** SIMULATION AND MODELLING QUESTION SEVEN  
**CODE:** SCS4108/ SCS6106

**INSTRUCTION TO CANDIDATES**

ANSWER **ALL** QUESTIONS IN SECTION A AND ANY **TWO** QUESTIONS IN SECTION B.

**Time: 3 hours**

**SECTION A (ANSWER ALL OF THE QUESTIONS IN THIS SECTION)**

**QUESTION ONE**

- i) Discuss the different features available to construct a flight simulator model using Stella. Refer to the features highlighted in the Communications tutorials. [8]
- ii) Discuss the pieces of the general discrete simulation model presented in the Powerpoint presentation in class. (This does not refer to the Arena components). [10]
- iii) Construct a system dynamics model of the Elephant population of Hwange National Park. Consider births, deaths, Hunting and migration. Break the population up into age categories.
- (a) Show the stock and flow diagram, [4]
  - (b) Bulls eye diagram [3]
  - (c) and causal loop diagram. [3]

- iv) Consider the 1<sup>st</sup> order negative feedback system – Goal seeking model discussed in class where you have an inventory that you want to reach a 'desired inventory'. The Order rate (OR) =  $(\text{desired\_inventory} - \text{inventory})/(\text{adjustment\_time})$  and The Sales = Sales\_rate \* inventory.
- (a) Given the desired inventory of 150, adjustment\_time of 5 weeks, and Sales\_rate of 20% calculate the inventory at equilibrium. [4]
- (b) Calculate the adjustment that must be made to the desired\_inventory to reach an equilibrium inventory of 120. [4]
- (c) Construct the associated stock and flow diagram [2]

**You must show your work.**

- v) Draw the flowchart model corresponding to an Arena simulation of ZIMBank. There is one queue for general information, another for normal transactions, another for bulk deposits and a final one for Forex transactions. The model should indicate the characteristics of the entities, resources and modules. [10]
- vi) We initially run  $n_0 = 5$  replications of a simulation and get a half-width of  $h_0 = 20$ . We have to reduce the half-width to 5. How many simulations replications must we run? **Show your calculations.** [10]
- vii) Compare and contrast Output analyzer, Process analyzer and OpQuest [10]
- viii) Construct the record for the first six minutes of a Hand simulation. The table should contain Just-Finished Events, Variables, Attributes, Event Calendar and the Statistical Accumulators P, N and Q\*. Reference the Appendix. Indicate the new table entries in your answer book. Use the inter-arrival times: (2.05, 1.85, 4.3, 6.8) and service times: (3.5, 1.3, 7.1) as needed. [12]

**SECTION B** (select any two from the following questions)

**QUESTION TWO**

Discuss any five of the eight system thinking skills discussed in the tutorial / PDF file on systems thinking? [10]

**QUESTION THREE**

Discuss the various generic non-linear patterns. What structural models are associated with each pattern? [10]

**QUESTION FOUR**

Discuss types of models, types of simulation, roles for simulation, and stages in problem solving using simulation. [10]

**QUESTION FIVE**

We initially run  $n_0 = 5$  replications of a simulation and get a half-width of  $h_0 = 20$ . We then run another 120 simulation replications. Calculate an approximation of the new half-width given this information. [10]

**Show your calculations.**

**END OF QUESTION PAPER**

**GOOD LUCK!**