



# KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR  
OF SCIENCE (COMPUTER SCIENCE)

SCS 306: SIMULATION AND MODELLING

DATE: Monday, 16<sup>th</sup> April, 2012

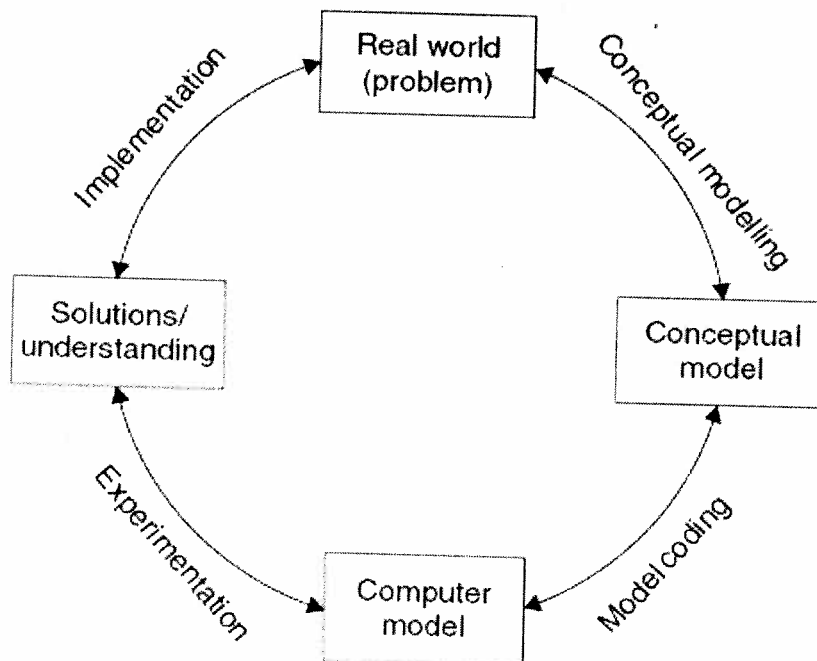
TIME: 11.00 a.m. – 1.00 p.m.

**INSTRUCTIONS:**

Answer question **ONE** and any other **TWO** questions.

**Question One (Compulsory)**

- a) Explain the simulation process as represented by the diagram below



(4marks)

b) Explain the typical applications of the following simulation software

- i. Arena
- ii. @RISK
- iii. AutoMod
- iv. AnyLogic

(4 marks)

c) State two limitations of the following

- i. Time slicing approach
- ii. Discrete event simulation

(4 marks)

d) Draw an Activity Cycle Diagram for a single server queue

(4 marks)

e) The time between arrivals at the game room in the student union is exponential with mean 10 minutes

- i. What is the arrival rate per hour
- ii. What is the probability that no students will arrive at the game room during the next 15 minutes
- iii. What is the probability that at least one student will visit the game room during the next 20 minutes

f) Suppose that a barbershop is operated by three barbers. Assume further that the utilization of the servers (barbers) is summarized as given in the following table:

| <u>Simulation time, T(hr)</u> | <u>No of busy servers.</u> |
|-------------------------------|----------------------------|
| $0 < T \leq 10$               | 0                          |
| $10 < T \leq 20$              | 1                          |
| $20 < T \leq 30$              | 2                          |
| $30 < T \leq 35$              | 1                          |
| $35 < T \leq 40$              | 0                          |
| $40 < T \leq 60$              | 1                          |
| $60 < T \leq 70$              | 2                          |
| $70 < T \leq 75$              | 3                          |
| $75 < T \leq 80$              | 2                          |
| $80 < T \leq 90$              | 1                          |
| $90 < T \leq 100$             | 0                          |

Determine the following measures of performance:

i) The average utilization of the facility .

(4 marks)

ii) The average idle time of the facility.

(4 marks)

(6 marks)

### **Question two**

Consider that a new airport terminal is to be built. The management may want to make decisions on the following issues:

- The number of check-in desks devoted to each airline;
- The size of the baggage handling system;
- The amount of security check positions;
- The number of departure gates;

- The number of staff to employ;
- The shifts that the employees work.

- Explain three solution options that the managers would have
- State two advantages and two disadvantages of each option
- Recommend the best solution option for the management

(20 marks)

### **Question three**

Consider a telephone call centre where calls arrive every 3 minutes and are passed to one of two operators who take 5 minutes to deal with the customer. There is no variation in the inter-arrival time and the service time. Using the time slicing model, carry out a simulation for 24 minutes to establish

- The number of calls completed by each operator
- The time remaining until a call arrives

(20 marks)

### **Question Four**

People arrive at a bank to be served according to the following distribution

| Inter-arrival Time | Frequency |
|--------------------|-----------|
| 2                  | 10        |
| 3                  | 20        |
| 4                  | 40        |
| 5                  | 20        |
| 6                  | 10        |

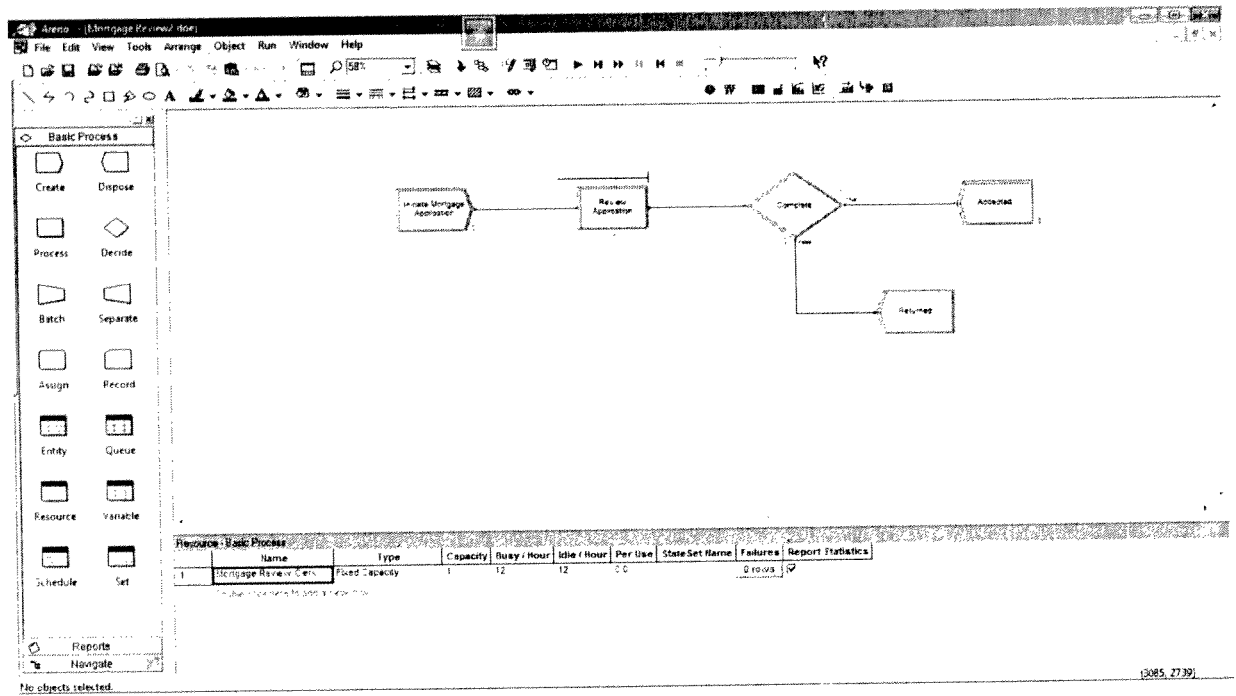
The service time is 4 minutes and there is only one server. The manager in charge is interested in predicting the operating characteristics of this counter during a typical working day from 10.00am to 11.00 am. Use simulation to determine the average waiting time in the service, using the following set of random numbers:

17,86,84,79,33,55,6,42,93,38,58,71

(20 marks)

## Question Five

Study the interface below and answer the questions that follow



- a) Explain the following modules
  - i. Create
  - ii. Dispose
  - iii. Process
  - iv. Decide

(8 marks)

- a) Briefly describe the procedure for modelling and simulating the Mortgage Application shown

(12 marks)

