KIMATHI UNIVERSITY COLLEGE OF TECHNOLOGY
University Examinations 2010/2011

THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN COMPUTER SCIENCE

<u>**ICS 2307 SIMULATION AND MODELING**</u>

DATE: 9TH DECEMBER 2010   **TIME:** 11-00 AM – 1.00 PM
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Instructions: Answer question ONE and any other TWO Questions

<u>**Question 1**</u>

a) Define the term simulation   (2 Marks)

b) State eight reasons that make simulation appropriate for many real world problems
                                                                                                (8 Marks)

c) Distinguish between model validation and model verification   (2 Marks)

d) Simulation models can be classified among three dimensions, state and explain them
                                                                                                (6 Marks)

e) Why would an analyst ever prefer a general purpose language such as BASIC in
    simulation when there are advantages of using special purpose languages such as
    GPSS, SIMSCRIPT, XCELL or SLAM   (6 Marks)

f) Highlight the significance of random numbers in simulation   (6 Marks)

<u>**Question 2**</u>

a) State and explain the components of a discrete event simulation model and show their
    logical relationship in a flow chart.   (14 Marks)

b) State and explain the three quantities that are used in measuring performance of a
    single server queuing system.   (6 Marks)

<u>**Question 3**</u>
a) (i) State any seven properties that a good random number generator should have
                                                                                                (7 Marks)

(ii) Distinguish between a multiplicative random number generator and a mixed random number generator (2 Marks)

b) A random number generator was used to generate values from a uniform distribution on the interval [0, 1] and the following variates were generated;0.2, 0.8, 0.6, 0.5, 0.9, 0.3, 0.8, 0.2, 0.6, 0.3, 0.7, 0.6, 0.9, 0.1, 0.7, 0.8, 0.4, 0.6, 0.8, 0.5 with classes 0 to less than0.2 0.2 to less than0.4,…………0.8 to less than 1.0 and a 95% confidence level, use the chi-square test to test if the data actually came from uniform distribution on [0, 1] or not (6 Marks)

c) Use a congruential multiplicative random number generator with a =7, m =113 and seed =79471 to generate the first five variates on the[0, 1] interval   (5 Marks)

Question 4

a) Excel bakery maintains sufficient stock of its 'Ever delight cake' and the daily demand is as under:

DD	0	10	20	30	40	50	60	70	80
Probability	0.02	0.16	0.23	0.15	0.13	0.12	0.10	0.06	0.03

Using the following sequence of random numbers simulate the demand for the next 12 days. IF the proprietor of the bakery decides to make 40 cakes daily, calculate the stock position at the end of the 12th day. Also calculate the daily demand for the cakes.
Random numbers: 36, 29, 84, 57, 19, 79, 46, 67, 08, 81, 87, 94.   (9 Marks)

b) Briefly explain
   i). Next event time advance mechanism
   ii). Fixed increment time advance mechanism   (6 Marks)

c) State and explain briefly the factors to consider when choosing which algorithm to use for a particular simulation.   (5 Marks)

Question 5
a) (i) State any <u>SEVEN</u> standard capabilities a simulation language should have for its optimum use.   (7 Marks)

   (ii).Outline any five key ways in which one simulation language may differ from another   (5 Marks)

b) Given the exponential distribution.

   i). $f(x) = \begin{cases} \lambda e^{-\lambda x}, & x > 0 \\ 0 & \text{elsewhere} \end{cases}$

   and
   ii).   the Weibull Distribution

   $f(x) = \begin{cases} \alpha \beta x^{\beta-1} \ e^{-\alpha x^{\beta}}, & x > 0 \\ 0 & \text{elsewhere} \end{cases}$

Show that during the simulation the procedure is to generate uniform random variates and apply $x = -\dfrac{1}{\lambda}\ln R$ for exponential variates and

$x = \left[-\dfrac{1}{\alpha}\ln R \right]^{1/\beta}$ for Weibull variates.   (8 Marks)