CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN COMPUTER SCIENCE

COSC 811: SIMULATION AND MODELLING

STREAMS: MSC (COMPUTER SCIENCE) **TIME: 3 HOURS**

DAY/DATE: MONDAY 12/08/2019 **8.30 A.M. – 11.30 A.M.**

INSTRUCTIONS:

- **Attempt any three questions**

QUESTION 1 (20 MARKS)

(a) What is your understanding of modelling? (2 marks)

(b) Explain four advantages of modelling in the real world applications. (4 marks)

(c) Algebraically show the three assumptions of the linear regression model. (3 marks)

(d) For a given data set, the variables are the duration of an eruption and the interval to the next eruption. Can be used to successfully predict using a simple linear model Using

(i) Find (5 marks)

(ii) Test (3 marks)

(iii) Find the confidence interval for (3 marks)

(iv) Compute and interprete the co-efficient of determination. (3 marks)

QUESTION 2 (20 MARKS)

(a) Explain the Black-Box modelling approach. (2 marks)

(b) Describe two advantages and the Black-box Modelling approach. (4 marks)

(c) State and explain three Black-Box Modelling techniques. (6 marks)

(d) Consider the table below. Determine which of the datasets are similar. (8 marks)

Dataset 1		Dataset 2		Dataset 3	
X	Y	X	Y	X	Y
3	14	1	21	1.5	-0.5
6	20	2	35	2.5	4.5
9	26	3	57	3.5	9.5
12	32	4	87	4.5	14.5
15	38	5	125	5.5	19.5
18	44	6	171	6.5	24.5
		7	225	7.5	29.5
		8	287	8.5	34.5

QUESTION 3 (20 MARKS)

(a) Define simulation as used in mathematics and computer science. (2 marks)

(b) Explain the steps involved in developing a simulation model. (10 marks)

(c) The following model with three regressors (including the constant) was estimated over 15 observations.

and the following computed from the original data

Calculate the parameter estimates for the regression models and carry out an hypothesis tests for each of the estimates. (8 marks)

QUESTION 4 (20 MARKS)

(a) Describe the pseudo-random numbers. (2 marks)

(b) One way of generating arbitrary distributing random variables is to convert uniformly distributed [0, 1] random variables into random variables drawn from the distributions we are interested in. Explain how this can be done using the transformation method.

(10 marks)

(**Hint**: Let X be the random variable we are interested in generating, and let F() be its distribution function i.e. F(

(c) Assume that a truncated poisson distributed random variable is supposed to be simulated if the truncated poisson distribution is given by

With 5 and 8. Show how you will generate truncated poisson random variables.

(8 marks)

QUESTION 5 (20 MARKS)

(a) The method described above to be used in question 4(b) above requires an analytic expression for the distribution function of the random variable. For a Gaussian rv, we do not have such an expression, so we need to find another way of generating such a random variable. Given that the density of a Gaussian variable is given by

Where and Required. Explain the four possible methods of simulating variables that follow a Gaussian distribution. (20 marks)
