



## MURANG'A UNIVERSITY COLLEGE

*A constituent college of Jomo Kenyatta University of Agriculture and Technology*

*University Examination 2015/2016*

### END OF SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY AND BUSINESS INFORMATION TECHNOLOGY:

#### ICS 2307: SIMULATION AND MODELLING

**DATE: DECEMBER 2015**

**TIME:**

**2 HOURS**

**Instructions:** Attempt question **One** and **Two** other questions

- a) State and explain any two simulation models [4marks]
- b) Business models usually consist of linked series of equations and formulae arranged so that they behave in a systematic manner to the real system being investigated. State four factors/variables that a simulation model should have. [4marks]
- c) State four advantages of using simulation other than experimenting with real life systems [4marks]
- d) The mean and standard deviation for the grade points of a random sample of 64 college students are calculated to be 3.6 and 0.4 respectively. Find the 95% and 99% confidence interval for the mean of the entire class. [6marks]
- e) State two reasons why random numbers are used in simulation [2marks]
- f) Excel bakery maintains sufficient stock of its ever delight cake and the daily demand is as given below

Daily demand	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

- (i) Using the following sequence of random numbers simulate the demand for the next 12 days. 23,45,23,21,69,32,02,44,47,75,85,36 [5marks]
- g) A company allows only 5% defective fuses in its production. A sample of 8 fuses is chosen. Calculate the probability of getting more than two defective fuses. [5marks]

## QUESTION TWO (20 MARKS)

- a) Define the term simulation [2marks]
- b) Outline the steps used in Monte Carlo method to simulate data [6marks]
- c) Write an R-statistical program that generates 1000 random numbers between 1 and 1000 from a binomial distribution where the value of  $p$  is 0.7. In your program include the code for calculating the mean, variance and standard deviation of the generated random numbers. Plot a bar plot for the generated random numbers. [5marks]
- d) A computer system has a Poisson distribution job arrival stream at an average rate of 2 per minute. Determine the probability that any one-minute interval there will be
  - (i) Exactly 3 jobs [3marks]
  - (ii) At most 3 job arrivals [4marks]

## QUESTION THREE (20 MARKS)

- a) Define the following terms as used in statistical estimation
  - (i) Statistical estimation [2marks]
  - (ii) Point estimate [2marks]
  - (iii) Interval estimation [2marks]
- b) A sample of 100 students at a polytechnic showed that 25 dropped out in their first year of study. Calculate the 95% confidence interval for the dropout rate of the population of all comparable students. [7marks]
- c) Define discrete event simulation and state five characteristics that it should possess [7marks]

## QUESTION FOUR (20 MARKS)

- (a) State any two properties of a normal distribution [2marks]
- (b) A tire company has invented a revolutionary new product. In order to overcome consumer resistance, a mileage guarantee is offered with the tire. Road test suggests that the mean life of the tire is 44,000 miles, with a standard deviation of, 4,000miles. The tests suggest that tire life is normally distributed.
  - (i) What percentages of the tires will last for more than 46, 000 miles? [4marks]
  - (ii) What percentages of the tires will last for less than 42, 000 miles? [4marks]
  - (iii) What percentages of tires will have a life between 39,000 miles and 44,000 miles? [5marks]
- c) The mortality rate of a certain disease is 40%. Of the ten patients who have the disease, what is the probability that more than three will die from the disease? [5marks]

**QUESTION FIVE (20 MARKS)**

- a) State and explain any two commonly used random number generators under simple random sampling. [4marks]
- b) Kodak photograph studios use an expensive grade of developing fluid when printing special colour portraits. Since the developed fluids cannot be stored for long periods, it is important to keep on hand only as much as is need to fill an anticipated demand. In the past few months, however demand for the product has been fluctuating. The owner has decided to simulate the demand for this source. A study Kodak photograph’s appointment book resulted in the following frequency distribution.

Daily demand	0	1	2	3	4	5
Number of days	10	20	40	20	6	4

Using the following sequence of random numbers: 35,92,68,03,51,05,72,84,98,34 generate a ten day daily demand (sequence of demand values) and estimate the expected daily demand.[10 marks]

- c) The quality department of a wire manufacturing company periodically selects a sample of wire specimens in order to test for the breaking strength. Past experience has shown that the breaking strengths of a certain type of wire are normally distributed with standard deviation of 200kg. A random sample of 64 specimens gave a mean of 6200 kg. Find out the population mean at 95% level of confidence. [6marks]