



# MACHAKOS UNIVERSITY

University Examinations for 2018/2019 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ACCOUNTING BANKING AND FINANCE

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF ECONOMICS AND STATISTICS

EES 402: OPERATIONS RESEARCH II

DATE: 7/8/2019

TIME:

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## INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other **TWO** questions

### QUESTION ONE (30 MARKS)

- a) Define the term simulation and describe any two areas where simulation can be applied (4marks)
- b) Write short notes on the following concepts (6marks)
  - i) Degeneracy
  - ii) Reneging
  - iii) Safety stock
- c) What is crashing? Describe in detail the requirements of crashing (5marks)
- d) The arrival rate of customers at a single window booking counter of a two wheeler agency follows Poisson distribution and the service time also follows poisson distribution. The arrival rate and service rate are 25 customers per hour and 35 customers per hour respectively. Find the following
  - i) Utilization of the booking clerk
  - ii) The average number of waiting customers in the queue
  - iii) The average number of waiting customers in the system
  - iv) Average waiting time per customer in the queue
  - v) Average waiting time per customer in the system (15marks)

## QUESTION TWO (20 MARKS)

- a) Consider a hospital that buys a certain antibiotic from a large supplier, the drug can be bought at the following prices;

Quantity	Price per unit (\$)
1-4999	2.75
5000-9999	2.6
10000 & above	2.5

The demand for the drug in the hospital is 50,000 units per year. There is an order cost of \$50 per order and a holding cost of 20% of the cost of the item per unit per year.

- Find the EOQ for price 1, 2 and 3 (i.e.  $Q_1^*$ ,  $Q_2^*$  and  $Q_3^*$ ) and compare them with the quantity required for the price break (4marks)
  - Determine the total annual cost for each of the minimum quantities for each price breaks. (4marks)
  - Determine the optimal purchasing policy for the hospital (2marks)
- b) The annual demand for a component is 7200 units. The carrying cost is Kshs 500 per unit per year, the ordering cost is Kshs 1500 per order and shortage cost is Kshs 2000 per unit. Find the optimal values of the following:
- Economic order quantity
  - Maximum inventory
  - Maximum shortage quantity
  - Cycle time
  - Inventory period
  - Shortage period (10 marks)

## QUESTION THREE (20 MARKS)

Mr. Kamau, a branch manager of Umoja Bank is planning to open a drive-in facility in a commercial area in Thika. A market survey has projected the inter-arrival times at the branch are as follows:

Time between two consecutive arrivals	Probability
3	0.17
4	0.25
5	0.25
6	0.20
7	0.13

The Bank management plans for one teller's window at this branch. The teller car service customer at these rates;

Service time (minutes)	Probability
3	0.10

4	0.30
5	0.40
6	0.15
7	0.05

Use the following random numbers:

Arrival time: 50,53,22,54,96,95,65,24,14,57,73,54,77,69,52,21,49,63,04,16,55,79,01,83,42

Service time: 72,45,17,48,40,22,75,69,86,45,84,16,54,93,48,46,76,46,31,01,22,29,36,79,83

Mr. Kamau wants to sign the contract but would like to know how much pace to allow for waiting cars. He is also concerned about the mean waiting time for arriving customers.

- i) Simulate the operation of the facility for arriving sample of 25 cars and assist Mr. Kamau in determining the number of cars he should plan for assuming that the banking business starts at 11.00am (12marks)
- ii) What is the longest time that a customer can wait before being served? (2marks)
- iii) What is the mean waiting time in your sample (3marks)
- iv) Advice Mr. Kamau accordingly (3marks)

#### QUESTION FOUR (20 MARKS)

- a) Outline the possible changes that can occur in sensitivity analysis (6marks)
- b) Consider the following problem;

$$\text{Max } \pi = 3x_1 + 4x_2$$

Subject to:

$$x_1 + x_1 = 6$$

$$2x_1 + 4x_2 = 20$$

$$X_1, X_2 > 0$$

- i) Construct the primal problem (2marks)
- ii) Apply simplex method to this model to yield optimal solution (12marks)

#### QUESTION FIVE (20 MARKS)

- a) Discuss the assumptions underlying economic order quantity model. (6marks)
- b) Discuss advantages and disadvantages of using simulation in decision making (6marks)
- c) Explain explicitly the purposes of keeping inventory in an organization. (8marks)

