



MACHAKOS UNIVERSITY

University Examinations for 2018/2019 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF ECONOMICS AND FINANCE

BACHELOR OF ECONOMICS

EES 402: OPERATIONS RESEARCH II

DATE: 2/5/2019

TIME: 2:00 – 4:00 PM

INSTRUCTIONS:

Answer Question ONE and any other TWO questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Discuss advantages and disadvantages of using simulation in decision making (5 marks)
- b) At a certain credit reference bureau nine people arrived every one hour to apply for a clearance certificate. The attendants took five minutes to serve each person on average. Assuming that the arrivals follow a Poisson distribution and the serving time follows an exponential distribution, determine the following.
- i) The percentage of time that there is no person being served at the bureau (2 marks)
 - ii) The average number of people at the bureau (2 marks)
 - iii) The average number of people waiting for their turn to be served (2 marks)
 - iv) The average time a person spends at the bureau (2 marks)
- c) A linear program is stated as follows

Minimize

$$W = 2y_1 + 3y_2$$

Subject to

$$y_1 + y_2 \geq 10$$

$$2y_1 + y_2 \geq 16$$

and

$$y_1 \geq 0, y_2 \geq 0$$

- i) Formulate the corresponding dual linear problem. (5 marks)
- ii) Solve the dual linear problem above using simplex method to find the solutions for both the maximization and minimization problems. (8 marks)
- iii) State and interpret the dual price for each constraint (4 marks)

QUESTION TWO (20 MARKS)

- a) State five Objectives of inventory control (5 marks)
- b) Discuss the assumptions underlying economic order quantity model (7 marks)
- c) A manufacturer has to supply his customers 52800 units of his product per year. The unit cost of the product is ksh.20 and the inventory carrying charges are 10% per annum. The cost of one procurement amounts to KShs. 300. Determine the following.
- i) Economic order quantity (2 marks)
 - ii) Number of orders per year (2 marks)
 - iii) Optimum period of supply per optimum order (2 marks)
 - iv) Optimum cost (2 marks)

QUESTION THREE (20 MARKS)

A building and construction company has three quarries for mining stones, A, B and C whose daily supplies are 152, 164 and 154 tonnes respectively. The company has three construction sites P, Q and R whose daily demands are 144, 204 and 82 tonnes respectively. The cost of transporting each tonne of stones from each quarry to every site in Kenya Shillings is given in the table below.

	Construction Sites		
	P	Q	R

	A	8	16	16
Quarry	B	32	48	32
	C	16	32	48

- a) Find the initial feasible solution for the transportation problem using Vogel's Approximation Method and the associated transport cost. (10 marks)
- b) Find the optimum transportation schedule and the minimum total cost of transportation. (10 marks)

QUESTION FOUR (20 MARKS)

- a) State five objectives of network analysis (5 marks)
- b) Describe five management applications of network analysis (5 marks)
- c) A construction project is composed of fourteen activities whose description relationships and durations in days indicated in brackets are described as follows.

Activity	Pre-requisite	Expected Time
	Activity	(days)
A	None	30
B	None	11
C	None	6
D	C	14
E	B	22
F	C	54
G	E & F	30
H	E & F	12
I	A	18
J	A	34
K	D, G, H & J	32
L	D & H	15

M	D, G, H & J	20
P	I & M	10

- i) Draw the network diagram for this project.
(5 marks)
- ii) Determine the earliest and latest start times and finish times and hence the critical path and project duration,
(5 marks)

QUESTION FIVE (20 MARKS)

A company produces two products A and B which go through two processes, that is sorting and packaging. It allocates three and five hours per day for sorting and packaging respectively. Product A requires one hour of sorting and three hours of packaging daily. Product B requires one hour of sorting and one hour packaging daily. Product A and B generate a profit of KShs 80 and KShs 60 per unit respectively.

- a) Formulate a linear program
(3 marks)
- b) Find the optimal product mix using graphical method
(5 marks)
- c) Determine the dual/shadow price for each process using graphical method
(4 marks)
- d) Determine the feasibility range for each process.
(4 marks)
- e) If the company can increase the capacity of both processes which process should receive higher priority and why?
(2 marks)
- f) Determine whether it is advisable to increase the period of each process at the additional cost of \$30.00 per hour.
(2 marks)