



# MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

THIRD YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF ECONOMICS AND FINANCE

BACHELOR OF ECONOMICS

EES 302: OPERATIONS RESEARCH I

DATE: 6/12/2019

TIME: 2.00-4.00 PM

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## INSTRUCTIONS:

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

### QUESTION ONE (40 MARKS)

- a) Explain briefly six merits of using quantitative basis for decision making regarding the best utilization of resources (6 marks)
- b) State four objectives of network analysis (4 marks)
- c) John and his brother Owen are playing the game of matching fair coins. If the coins match John gets KShs 500 from Owen but if the coins do not match Owen gets KShs 500 from John.
- Generate a payoff Matrix for the game (2 marks)
  - Determine the optimum strategies for the players and the value of the game. (8 marks)
- d) A textile manufacturing company produces two types of bags A and B from its available resources which consist of 400 metres of fabric and 450 units of labour daily. Product A requires 5 metres of fabric and 10 units of labour. Product B uses 20 metres of fabric and 15 units of labour. The company sells the bags at \$900 and \$1600 per unit of type A and B respectively.
- Formulate the problem as linear programming model (3 marks)
  - Find the number of units for each type of the bag that the company should make to maximize profit. Use graphical method. (7 marks)

- e) Carex Motors Ltd advertised four second hand vehicles for sale and received the following quotations in thousands of shillings from four potential buyers.

		Car model			
		Fielder	Premio	Nissan	Wish
Makau	650	710	635	710	
Buyers Otieno	770	860	660	710	
Mwangi	554	590	560	610	
Wafula	750	810	635	590	

If each buyer is assigned one car determine the optimal assignment for the company in order to maximize revenue. Find the total revenue. (10 marks)

### QUESTION TWO (15 MARKS)

A trader buys vegetables of fruit at a cost of KShs 500 per bag and sells each at KShs 1000 in her grocery shop. From the past experience the daily demands for the vegetables at her shop range from 10, 20, 30 and 40 bags. She also supplies the vegetables in the same range of the demands. She sells any vegetables that remain after every day at KShs 800 per bag.

- a) Generate the following a conditional pay-off table (5 marks)
- b) Determine her optimal strategy based on the following criteria:
- i) Maximax criterion (3 marks)
  - ii) Maximin criterion (3 marks)
  - iii) Laplace criterion (4 marks)

### QUESTION THREE (15 MARKS)

A project has the following characteristics:

Activity	Pre-requisite	Time		Cost	
		Normal	Crash	Normal	Crash
A	-	10	8	1000	1200
B	-	7	4	600	840
C	B	15	11	1200	1600
D	A&B	6	5	800	900
E	B	8	4	1300	1500
F	C & D	9	4	1500	2000
G	E&F	12	6	1800	3000
H	A&B	13	10	800	1100

- i) Draw the network diagram and identify the critical path (7 marks)
- ii) Find the normal project duration and the associated cost (3 marks)
- iii) Crash the relevant activities systematically and determine the optimal Project time and cost. (5 marks)

**QUESTION FOUR (15 MARKS)**

A Company has three depots, P, Q and R for its produce with capacity of 80, 240 and 280 units respectively. The depots supply the produce to four towns, A, B, C and D whose demands are 120, 120, 160 and 200 units respectively. The per unit transport costs in US Dollars from one depot to a given town are given in the table below.

		Towns			
		A	B	C	D
Depots	P	28	24	32	42
	Q	36	30	26	28
	R	38	38	32	26

- a) Find the initial feasible solution for the transportation problem using the Vogel's Approximation Method and calculate the associated cost. (7 marks)
- a) Find the optimal solution for the transportation problem using the initial solution obtained above and calculate the associated cost. (8 marks)

**QUESTION FIVE (15 MARKS)**

A toy manufacturing company makes three types of products labelled A, B and C. The production process requires three main inputs namely iron, plastics and labour. The following table gives the availability of the resources, their usage by the three products and selling price per unit in Kenya Shillings.

Resources	Resource requirement per unit			Daily availability
	A	B	C	
Iron (Kgs)	4	2	2	30 Kgs
Labour (hours)	6	6	24	60 hrs
Plastics (Kgs)	2	3	1	32 Kgs
Price per unit (\$)	1200	800	400	

- a) Formulate a linear program using the above information. (5 marks)
- b) Solve the linear program formulated in part a above to find the number of units for each type of product that the company should make in order to maximize its revenue. (10 marks)