



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE

EMM 413: OPERATIONS RESEARCH

DATE: TUESDAY 17TH APRIL 2012

TIME: 2.00 P.M. – 4.00 P.M.

INSTRUCTIONS:

- (i) All questions carry equal marks.
- (ii) There are FIVE questions in this paper.
- (iii) Answer ANY THREE questions.

QUESTION ONE

- (a) Differentiate between graphical method and simplex method in Linear programming. (4 marks)
- (b) Outline steps of simplex algorithm for a maximization problem. (4 marks)
- (c) Nairobi Furniture Company manufactures desks, tables and chairs. The manufacture of each type of furniture requires lumber and two types of skilled labour finishing and carpentry. The amount of each resource needed to make each type of furniture is given in Table Q1

Table Q1:

Resource	Desk	Table	Chair
Lumber	0.24m	0.18m	0.03
Finishing hours	4 hours	2 hours	1.5 hours
Carpentry hours	2 hours	1.5 hours	0.5 hours

At present, 1.44 m of lumber, 20 finishing hours and 8 carpentry hours are available. A desk sells for Ksh. 480, a table for Ksh. 240 and a chair for Ksh. 160. The company believes that demand for desks and chairs is unlimited, but at most five tables can be sold. Since the available resources have already been purchased, the company wants to maximize total revenue.

Solve the problem using simplex method. (12 marks)

QUESTION TWO

- (a) What do you understand by the following terms:
- (i) Transcient state (1 mark)
 - (ii) state of system (1 mark)
 - (iii) balked customer (1 mark)
 - (iv) Finite source (1 mark)
- (b) Discuss following process in queuing theory:
- (i) Impact process (2½ marks)
 - (ii) Output process (2½ marks)
 - (iii) Queue Discipline (3 marks)

- (c) An average of 12 cars per hour arrive at a single server drive in teller. Assume the average service time for each customer is 4 minutes and both interarrival times and service times are exponential. Answer the following questions:
- (i) What is the probability that the teller is idle? (2 marks)
 - (ii) What is the average number of cars waiting in line for the teller? (2 marks)
 - (iii) What is the average amount of time a drive-in customer spends in the bank parking lot (including time in service). (2 marks)
 - (iv) On the average how many customers per hour will be served by the teller? (2 marks)

QUESTION THREE

- (a) What is the meaning of the following terms:
- (i) Supply constraint
 - (ii) Transportation tableau
 - (iii) Dummy demand point
 - (iv) Loop (4 marks)
- (b) Discuss the process of finding basic feasible solution for a transportation problem. (6 marks)
- (c) Touche Young has three auditors. Each can work upto 160 hours during the next month, during which time three projects must be completed. Project 1 will take 130 hours, project 2, 140 hours, and project 3, 160 hours. The amount per hour that can be billed for assigning each auditor to each project is given in Table Q3. Formulate a balanced transportation problem to maximize total billings during the next month.

Table Q3

Auditor	Project		
	1	2	3
1	Ksh. 1200	Ksh. 1500	Ksh. 1900
2	Ksh. 1400	Ksh. 1300	Ksh. 1200
3	Ksh. 1600	Ksh. 1400	Ksh. 1500

QUESTION FOUR

(a) What is the meaning of the following terms:

- (i) Perfect information (1 mark)
- (ii) Dominated action (1 mark)
- (iii) Decision Tree (1 mark)
- (iv) Simple lottery (1 mark)

(b) News vendor Phyllis sells newspapers in Ruiru and each day she must determine how many newspapers to order. Phyllis pays the company Ksh 40 for each paper and sells the papers for Ksh 50 each. Newspapers that are unsold at the end of the day are worthless. Phyllis knows that each day she can sell between 60 and 100 papers, with each possibility being equally likely. Show how this problem fits into the state-of-the world model. (10 marks)

- (c) For the network in figure Q4 find the maximum flow from source to sink. Also find a cut whose capacity equals the maximum flow in the network. (6 marks)

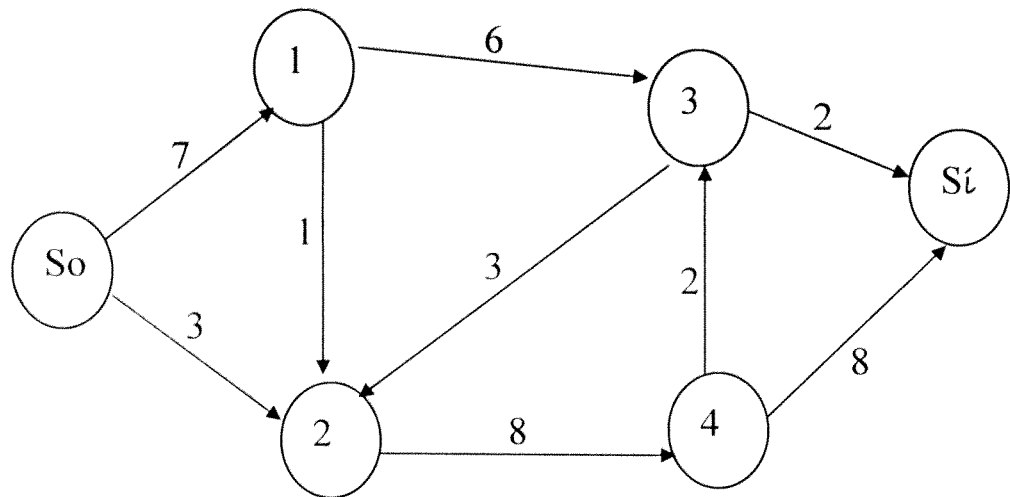


Figure Q4

QUESTION FIVE

- (a) Discuss the differences between integer programming and linear programming. (4 marks)
- (b) Dorian Anto is considering manufacturing three types of autos: compact, midsize and large. The resources required for and the profits yielded by, each type of car are shown in table Q5(i). At present, 6000 tons of steel and 60,000 hours of labour are available. For production of a type of car to be economically feasible, at least 1000 cars of that type must be produced. Formulate an IP to maximize Dorian's profit. (8 marks)
- (c) There are five constituencies in Bomet county. The county must determine where to build tea factories. The county wants to build the minimum number of factories needed to ensure that at least one factory is within 15 minutes (driving time) of each constituency. The times (in minutes) required to drive between the constituencies in

Bomet county are shown in Table Q5(ii). Formulate an IP that will tell Bomet county how many tea factories should be built and where they should be located.

Table Q 5(i)

	Compact	Midsize	Large
Steel required	1.5 tons	3 tons	5 tons
Labour required	30 hours	25 hours	40 hours
Profit yielded	Ksh 160,000	Ksh 240,000	Ksh 320,000

Table Q 5(ii)

FROM	TO				
	Konoin (Kn)	Chepalungu (Ch)	Bomet Central (Bc)	Bomet East (BE)	Sotik (St)
Kn	0	10	20	30	30
Ch	10	0	25	35	20
Bc	20	25	0	15	30
Be	30	35	15	0	15
St	30	20	30	15	0

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