SECTION A (20 MARKS)

1. (a) State the main assumptions in a sequencing model [3 marks]

(b) Narok farmer's co-operative mixes two brands of cattle feed; Cattle Grower and Cattle Finisher. Cattle Grower costs shs.2100 per bag and contains 2 units of fat, 2 units fibre and 2 units protein. Cattle Finisher costs shs.1,680 per bag and contains 1 unit of fat, 9 units of fibre and 3 protein. The minimum requirements of nutrients fat, fibre and protein are 12 units, 36 units, and 24 units, respectively.

i Formulate the linear programming problem and using the graphical method, find the number of bags of each brand that should be mixed to produce a mixture having a minimum cost per bag. [5 marks]

ii Formulate the dual of this problem. [2 marks]

(c) Umeme company has three electric power plants that supply the electric needs of four counties. Formulate an initial feasible solution to Umeme company transportation problem using:

i Northwest Corner method. [5 marks]

ii Minimum Cost Method. [5 marks]

From (Plant)	County I	County II 2	County III	County IV	Supply (Million kwh)
Plant I	\$8	\$6	\$10	\$9	35
Plant II	\$9	\$12	\$13	\$7	50
Plant III	\$14	\$9	\$16	\$5	40
Demand (Million kwh)	45	20	30	30	180

SECTION B (15 MARKS EACH)

2. (a) A small project is composed of 7 activities whose time estimates in weeks are listed below.

Activity	Predecessors	Optimistic	Most likely	Pessimistic
A	-	1	2	4
B	-	5	6	7
C	-	2	4	5
D	A	1	3	4
E	C	4	5	7
F	A	3	4	5
G	B,D,E	1	2	3

i Draw the network [2 marks]

ii Calculate the expected project duration and the variance of the project duration based on network analysis. [4 marks]

iii Find the expected project completion time [2 marks]

(b) State and explain the three main reasons for holding inventory and give a few reasons why only minimal inventories should be held. [3 marks]

(c) Trucks at a single platform weigh-bridge arrive according to Poisson probability distribution. The time required to weigh the truck follows an exponential probability distribution. The mean arrival rate is 12 trucks per day, and the mean service rate is 18 trucks per day. Determine the following:

i The probability that no trucks are in the system? [1 marks]

ii The average number of trucks waiting for service? [1 marks]

iii The average time a truck waits for weighing service to begin? [1 marks]

iv The probability that an arriving truck will have to wait for service? [1 marks]

3. (a) Describe a dominant strategy equilibrium as used in game theory. [3 marks]

(b) Two computer companies (Levunu computer ltd and Asas premium ltd) are simultaneously planning newspaper advertising campaigns. They plan their campaigns in secret and run them simultaneously. A promotional offer is an integral part of any campaign they run. Both companies choose between offering a lower price, a free printer or an extended warranty. The pay-offs in table 1 represent expected profits.

		Levunu computers ltd		
		Lower price	Free printer	Extended warranty
Asas premium ltd	Lower price	0,4	4,0	5,3
	Free printer	4,0	0,4	5,3
	Extended warranty	3,5	3,5	6,6

Table 1: Computer advertising campaign

Identify a Nash equilibrium if one exists. [5 marks]

(c) The Kenya Navy wishes to assign four ships to patrol four sectors (A,B,C,D) of the Indian ocean. In some areas ships are to be on the outlook for illegal fishing boats, and in other sectors to watch for enemy submarines, so the commander rates each ship in terms of its profitable efficiency in each sector. These relative efficiencies are illustrated in the table below.

	Sector			
Ship	A	B	C	D
1	20	60	50	55
2	60	30	80	75
3	80	100	90	80
4	65	80	75	70

Table 2: Computer advertising campaign

On the basis of the ratings shown, what patrol assignments should the commander use to produce the greatest overall efficiencies. [7 marks]

4. (a) The advertising alternatives for a company include television, radio, and newspaper advertisements. The costs and estimates for audience coverage are given in the table below.

	Television	Newspaper	Radio
Cost per advertisement	\$2000	\$600	\$300
Audience per advertisemnet	100,000	40,000	18,000

The local newspaper limits the number of weekly advertisements from a single company to ten. Moreover, in order to balance the advertising among the three types of media, no more than half of the total number of advertisements should occur on the radio, and at least 10% should occur on television. The weekly advertising budget is \$18,200. How many advertisements should be run in each of the three types of media to maximize the total audience? Use the simplex method to solve this problem. [15 marks]

THE END