KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF ARTS, BACHELO OF EDUCATION AND BACHELOR OF SCIENCE

SMA 461: OPERATION RESEARCH II

DATE: **Tuesday 3rd April 2012** **TIME:** **8.00a.m -10.00p.m**

INSTRUCTIONS

Answer question ONE and any other TWO questions

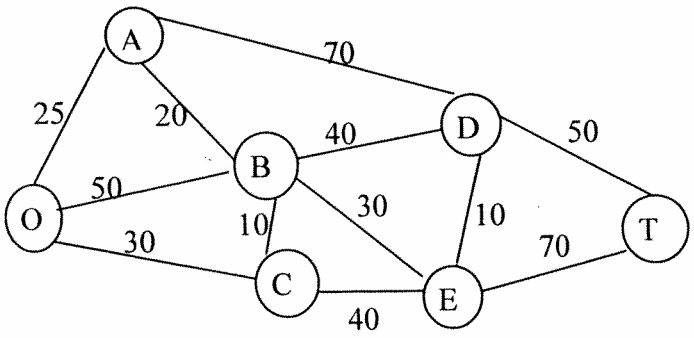
Question one (30 Marks)

(a) Differentiate between the following terms;

(i) Minimum span problem and the shortest route problem [2 Marks]

(ii) a state and a stage in dynamic programming algorithm [2 Marks]

(b) Tom and Jerry Co Ltd needs to install internet in their premise. The diagram below designates different offices (given by the nodes) that need to be connected and the distances (in meters) between the designated terminals.



Suppose the server is in office labeled O, determine how the internet cables should be laid from the server in order to connect all offices with a minimum total length of cables. [6 Marks]

(c) Explain any four characteristics of dynamic programming problems [4 Marks]

(d) The production department for a company requires 3,600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is \$36 and the cost of carrying inventory is 25% of the investment in the inventories. The rice is \$10 per kg. Determine

(i) Economic Order Quantity [2 Marks]

(ii) Number of orders per year [2 Marks]

(e) A large restaurant has 10,000 colored light bulbs. When any bulb fails it is replaced. The cost of replacing a bulb individually is $1 only. If all the light bulbs are replaced at the same time, the cost per bulb would be reduced to $ 0.35. The percentage of surviving bulbs S(t) at the end of the month t and the probability of failure P(t) during the month t are:

T	0	1	2	3	4	5	6
S(t)	100	97	90	70	30	15	0
P(t)	-	0.03	0.07	0.20	0.40	0.15	0.15

Determine;

(i) Individual replacement plan [4 Marks]

(ii) Group replacement plan [6 Marks]

(iii) Which replacement plan is optimal? Give a reason for your answer [2 Marks]

Question 2 (20 Marks)

(a) (i) Differentiate between transshipment and assignment problem [2 Marks]

(ii) Dady's three children, Martin, Jose and Terri want to earn some money to take care of personal expenses during a school trip to Nairobi National Park. Dady has chosen three chores for the children: mowing the lawn, painting the garage door and washing the family cars. To avoid anticipated children competition he asks them to submit secret bids for what they feel is fair play for each of the three chores. The understanding is that all three children will abide by their father's decision as to who gets which chore. The table below summarizes the bids received.

	Mow	Paint	Wash
Martin	$15	$10	$9
Jose	$9	$15	$10
Terri	$10	$12	$8

Based on this information, determine how Dady should assign the chores. [8 Marks]

(b) An individual who lives in Thika would like to travel to Westlands using intermediate points. The distances between these towns are given below. Any empty cell means that there is no route connecting the two intermediate points.

	Thika	Juja	Kasarani	Kiambu	Forest road	Westlands
Thika		8		32		
Juja	8		15	28		
Kasarani		15		13		32
Kiambu	32	28	13		10	13
Forest road				10		5
Westlands			32	13	5	

Required:

(i) Develop the master list [2 Marks]

(ii) Determine the minimum time this individual takes to travel from Thika to Westlands using the shortest route algorithm [8 Marks]

Question 3 (20 Marks).

(a) Explain the four costs associated with an inventory problem [4 Marks]

(b) Develop the Economic Order Quantity for an inventory with a constant rate of demand with instantaneous order replenishment and no shortage given that y=order quantity (number of units), D= rate of demand (units per unit time) and t_0 =ordering cycle length (time units)

[9 Marks]

(c) A company stocks an item that is consumed at the rate of 50 units per day. It costs the company $20 each time an order is placed. An inventory unit held in stock for a week will cost $0.35 Determine the optimum inventory policy, assuming a lead time of 1 week

[7 Marks]

Question 4 (20 Marks)

(a) Outline any three primary rules in constructing Activities On Arrows (AOA) diagram of a network. [3 Marks]

(b) Explain the meaning of the term *Critical path* of a project network. [2 Marks]

(c) The following table gives various activities that are scheduled to be undertaken by a business man before launching a new product in a market.

Activity	*Description*	*Required Predecessor*	*Duration* ()
A	Product design	(None)	5
B	Market research	(None)	1
C	Production analysis	A	2
D	Product model	A	3
E	Sales brochure	A	2
F	Cost analysis	C	3
G	Product testing	D	4
H	Sales training	B, E	2
I	Pricing	H	1
J	Project report	F, G, I	1

(i) Draw the project network [5 marks]

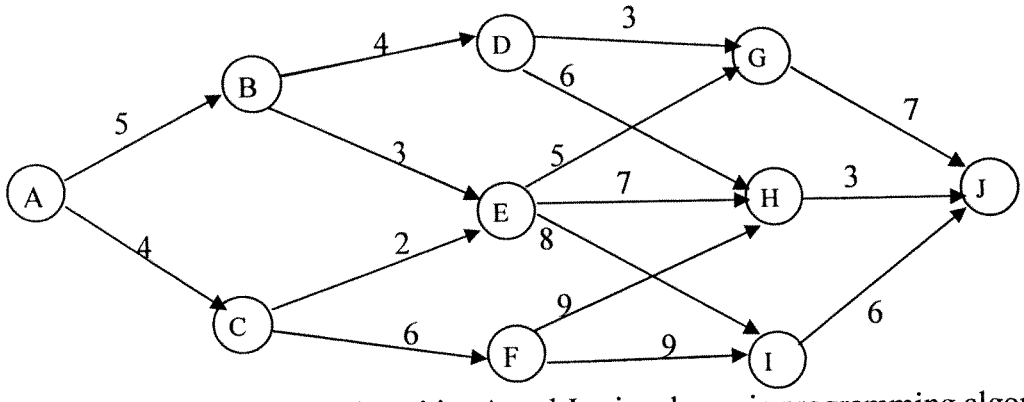
(ii) Determine the critical path [8 Marks]

(iii)Hence, find the project completion time [2 Marks]

Question Five [20 Marks]

(a) Explain the objective of dynamic [3 Marks]

(b) A company has to transport some goods from city A to city J. The cost of transportation between different cities is given in the following network.



Find the optimal route connecting cities A and J using dynamic programming algorithm. [12 Marks].

(c) A purchase price for a machine is Ksh71, 000. Its running costs per year and resale values are given as follows:

Year	1	2	3	4	5	6	7	8
Maintenance cost f(t)(in '000 ksh)	20	21	23	26	30	35	41	46
Resale value (in thousand ksh)	40	30	22	16	14	7	7	7

Determine when the machine should be replaced [5 Marks]