MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
FIRST YEAR FIRST SEMESTER

SCHOOL OF BUSINESS AND ECONOMICS
BACHELOR OF SCIENCE (ECONOMICS)
BACHELOR OF SCIENCE (FINANCIAL ECONOMICS)
BACHELOR OF SCIENCE (ECONOMICS AND STATISTICS)

COURSE CODE: ECO 3107

COURSE TITLE: OPERATIONS RESEARCH

DATE: 14TH DECEMBER, 2018 **TIME: 1100 - 1300HRS**

INSTRUCTIONS TO CANDIDATES

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

This paper consists of 6 printed pages. Please turn over.

QUESTION ONE **(25 MARKS)**

(a)Explain what you understand by the term Operations Research and give its main objective. **(3 marks)**

(b) Develop a general mathematical formulation of Linear Programming problem clearly stating your variables and coefficients (**4 marks)**

(c) Company X prepares and packages three Christmas gift packages containing sausages and cheese. The Tasters delight gift package contains 3 sausages and 6 cheeses. The succulent delight contains 5 sausages and 4 cheeses. The Gourment delight package contains 6 sausages and 5 cheeses. The company has 2500 sausages and 3000 cheeses available for packaging; and it believes that all gift packages can be sold (based on previous demand). Profits are estimated at ksh 2.50 for the Taster delight gift package, ksh3.50 and ksh4.00 for the Gourment delight gift package.

Required: Formulate this problem as a Linear Programming Problem **(3 marks)**

(d) Given the problem below

Minimize $z=2X_1 + 3X_2$

s.t $X_1 \geq 25$

$X_1 + X_2 \geq 350$

$2X_1 + X_2 \leq 600$

$X_1, X_2 \geq 0$

Diagrammatically, determine the optimal solution (**5 marks)**

(e) Solve the following Linear Programming problem using the Simplex Method

Max $Z = 12X_1 + 15X_2 + 14X_3$

S.t $-X_1 + X_2 \leq 0$

$-X_1 + 2X_3 \leq 0$

$X_1 + X_2 + X_3 \leq 100$

$X_1, X_2, X_3 \geq 0$ **(10 marks)**

QUESTION TWO **(15 MARKS)**

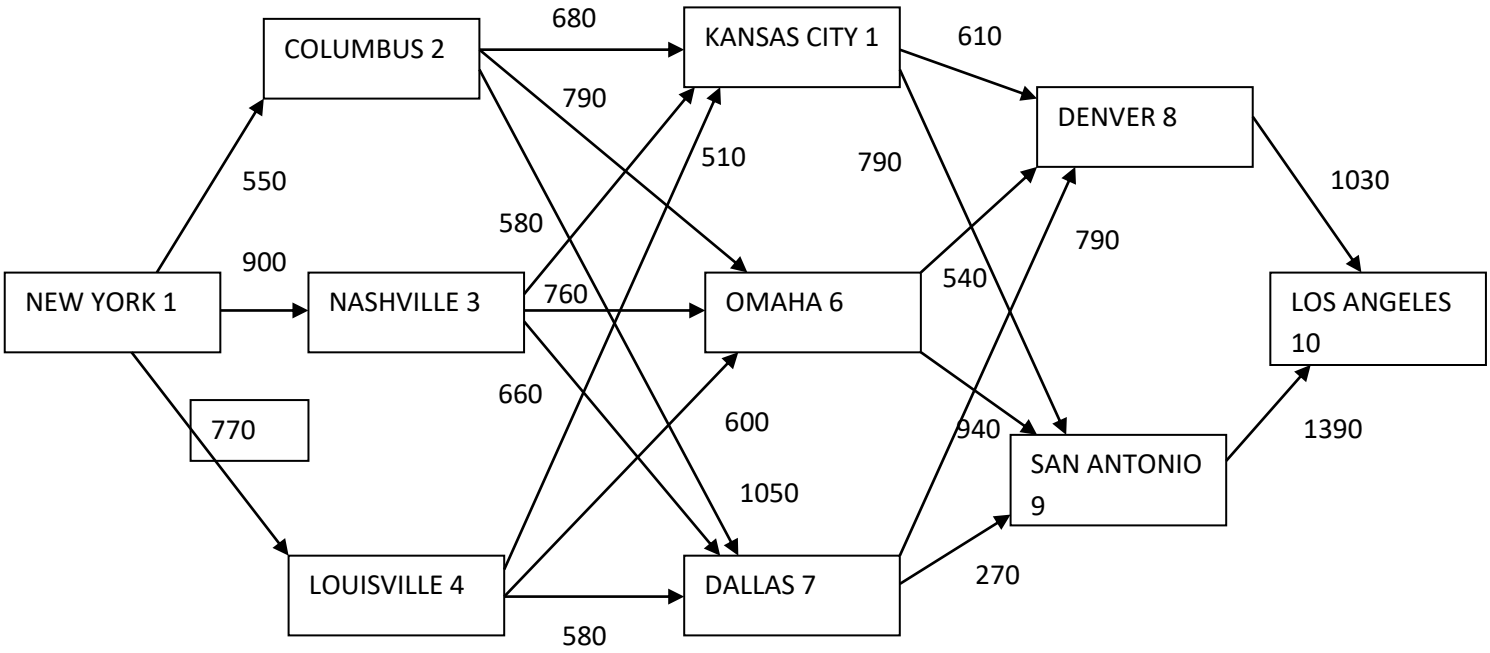
a)State Bellman's principle of optimality as applied to Dynamic programming **(5 marks)**

b) Mary lives in New York City but she plans to drive to Los Angeles to seek fame and fortune. Mary's funds are limited, so she has decided to spend each night on of her trip at a friend's house.

Mary has friends in Columbus, Nashville, Louisville, Kansas City, Omaha, Dallas, San Antonio and Denver.

Mary knows that after one day's drive she can reach Columbus, Nashville or Louisville. After two days of driving, she can reach Kansas City, Omaha or Dallas. After three days of driving she can reach San Antonio or Denver. Finally after four days of driving she can reach Los Angeles.

Given the actual road distance between cities as below, determine where Mary should spend each night of the trip in order to minimize the distance (kms) travelled using Forward Recursion Approach. **(10 marks)**



c) A seven tin vessel is loaded with one or more of four items. The table below gives the unit weight in tons, unit price in thousands of Kenya shillings for each of item i.

Item (i)	Weight (w_i)	Price (p_i)
1	1	20
2	3	40
3	2	30
4	4	25

Using the backward recursion procedure, determine how the vessel should be loaded to minimize total revenue (v_i), given $v_i=w_ip_i$ **(10 marks**)

QUESTION THREE (15 MARKS)

(a) Clearly explaining your variables and constants develop a tabular formulation of a general Transportation problem. **(5 marks)**

(c) Given the transportation problem below

	A	**B**	**C**	**D**	**E**	**F**	**G**	**CAPACITY**
1	6	7	5	4	8	6	5	**7000**
2	10	5	4	5	4	3	2	**4000**
3	9	5	3	6	5	9	4	**10,000**
REQTS.	**1000**	**2000**	**4500**	**4000**	**2000**	**3500**	**3000**	

Determine the feasible solution using the Vogels Approximation Method **(10 marks)**

QUESTION FOUR - (15 MARKS)

A project of building a backyard swimming pool consist of nine major activities. The activities and their immediate predecessors, time estimates (in days) for this project are given as below

ACTIVITY	IMMEDIATE PREDICESSOR	OPTIMISTIC TIME	MOST PROBABLE TIME	PESSIMISTIC TIME
A	_	**3**	**5**	**6**
B	_	2	4	6
C	A , B	5	6	7
D	A , B	7	9	10
E	B	2	4	6
F	C	1	2	3
G	D	5	8	10
H	D , E	6	8	10
I	E , G ,H	3	4	5

Required;

(a) Draw the network + **(2 marks)**

(b) Determine the critical path activities **(2 marks)**

(c) Find the estimate of the variance of each activity **(3 marks)**

(d) Determine the expected time to complete the project. **(4 marks)**

(e) Find the probability that the project can be completed in not more than 25 working days. **(4 marks)**

QUESTION FIVE (15 MARKS)

a) A supplier of the university has introduced Quantity discount to encourage the university to make large orders. The price schedule of the supplier is as below;

Order Quantity	Acquisition cost per unit (Ksh)
1 – 499	30
500 – 999	28
1000 and above	25

The university has approached you as a management science specialist to investigate this order and advice accordingly. The university has the option of receiving this order (the annual order) all at once or gradually over time In your preliminary investigations you have established the following estimates;

i. The university's annual demand for product X is estimated at ksh3000.
ii. The cost of placing and receiving the order is ksh 5/ per order.
iii. Stock holding cost is 20% of the acquisition cost.
iv. The university uses product X out of inventory at the rate of 40 units per day.
v. When orders are delivered gradually , the supplier can do so at the rate of 100 units per day

Required;
a)Using well labeled diagram determine the **Economic Order Quantity** for each of the options (gradual delivery and delivery all at once. **(10 marks)**
b)Comparing the two options advice the university on the best option to take clearly justifying your answer **(5 marks)**

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