TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE & STATISTICS AND COMPUTER SCIENCE

AMA 4305: OPERATIONS RESEARCH 1

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE: Pick DateMay2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

PAPER 1

QUESTION ONE (30 MARKS)

a) Define the following:-

i. Operations research [1 Mark]

ii. Optimization [1 Mark]

iii. Decision making under risk [1 Mark]

iv. Dual problem [1 Mark]

b) A tourist car operator finds that during the past few months, the car's use has varied so much that the cost maintaining it varied considerably. During the past 200 days, the demand for the car fluctuated as follows:

Trips per week	0	1	2	3	4	5
Frequency	16	24	30	60	40	30

Simulate the demand for a 10 week period using the random numbers

82 96 18 96 20 84 56 11 52 03 [7 Marks]

c) Determine an initial basic feasible solution to the following transportation problem using the North-West-Corner-Rule

Destination / Origin	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	**14**
O_2	8	9	2	7	**16**
O_3	4	3	6	2	**5**
Required	**6**	**10**	**15**	**4**	

[6 Marks]

d) Construct a network for the project whose activities and their precedence relationships are as given below

Activity	A	B	C	D	E	F	G	H	I	J	K
Predecessor	-	-	-	A	B	B	C	D	E	H,I	F,G

[5 Marks]

e) A company produces 2 types of hats. Every hat A has requires twice as much labour as the second hat B. If the company produces only hat B then it can produce a total of 500 hats a day. The market limits daily sales of the hat A and hat B to 150 and 250 hats. The profits on hats A and B are 8 shillings and 5 shillings respectively. Use graphical method to get the optimal solution. [8 Marks]

QUESTION TWO (20 MARK

(a) Determine an initial basic feasible solution for the following transportation problem using the Matrix - Minimax method

	DESTINATION				
	D_1	D_2	D_3	D_4	SUPPLY
O_1	6	4	1	5	**14**
O_2	8	9	2	7	**16**
O_3	4	3	6	2	**5**
Required	**6**	**10**	**15**	**4**	

[6 Marks]

(\b) The table below shows the rim requirements of a transportation problem

	DESTINATION				
	D_1	**D_2**	**D_3**	**D_4**	**SUPPLY**
O_1	2	2	2	1	**3**
O_2	10	8	5	4	**7**
O_3	7	6	6	8	**5**
Required	**4**	**3**	**4**	**4**	

i. From the table, obtain the initial basic feasible solution of the transport problem using Vogel's Approximation Method (VAM) [6 Marks]

ii. Show that the initial basic solution is optimum [8Marks]

QUESTION THREE (20 MARKS)

A small project is composed of seven activities whose time estimates are listed in the table below:

Activity	Estimated duration (weeks)		
	Optimistic	Most likely	Pessimistic
1 – 2	1	1	7
1 – 3	1	4	7
2 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

a) Find the expected duration and variance of each activity [8 Marks]

b) Draw the project network [4 Marks]

c) Find the critical path [2 Mark]

d) Calculate the expected project length [2 Marks]

e) If the project due date is 19 weeks, what is the probability of meeting the due date? [4 Marks]

QUESTION FOUR (20 MARKS)

a) Use simplex method to maximize $15x_1 + 6\,x_2 + 9x_3 + 2x_4$ subject to

$$2x_1 + x_2 + 5x_3 + 6x_4 \le 20$$
$$3x_1 + x_2 + 3x_3 + 25x_4 \le 24$$
$$7x_1 + x_4 \le 70$$
$$x_1, x_2, x_3, x_4 \ge 0$$

[14 Marks]

b) A sample of 100 arrivals of a customer at a retail sales depot is as follows:

Time between arrival (min)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Frequency	2	6	10	25	20	14	10	7	4	2

Simulate the inter-arrival times for the next 10 days.

Use random numbers 93 22 53 64 39 07 10 63 78 35 [6 Marks]

QUESTION FIVE (20 MARKS)

a) A company purchases 9000 parts of a machine for its annual requirements, ordering one month's usage at a time. Each part costs £20. The ordering cost per order is £15 and the carrying charges are 15% of the average inventory per year. You have been asked to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year? [9 Marks]

b) A newspaper vendor has the following probability of selling a newspaper:

No. of papers sold	10	11	12	13	14
Probability	0.10	0.15	0.20	0.25	0.30

The cost of a copy is Ksh 30 and the sale price is Ksh 50. He cannot return unsold copies. How many copies should he order? [11 Marks]