MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION FOR, BACHELOR OF SCIENCE IN MATHEMATICS &COMPUTER SCIENCE (**YEAR THREE**), BSM&E (**YR 3**), BSM&E (**YR 4**), BBIT

AMS 319 – O PERATIONS RESEARCH1

DURATION: 2 HOURS

DATE: 17/04/2019

TIME: 2:00-4:00PM

Instructions to candidates:

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) Define operations research 2marks

b) Explain briefly what you understand by the following terms as used in queuing theory.

i. Queue
ii. Service
iii. Customer 3marks

C) A mini-supermarket has a cashier who serves 48 customers per hour on average during the rush hour. The customers arrive at a rate of 40 per hour. Assuming a single channel queuing model, determine

i. The average time a customer spends in the queue waiting for the service 2marks
ii. The average number of customers in the queue 2marks

d) A baby food manufacturer wishes to mix two brands of food so that the vitamin content per kilogram of the mixture is at least 18 units of vitamin A, 14 units of vitamin B, 20 units of vitamin C and 24 units of vitamin D. the vitamin content per kg of each brand is shown in the table blow.

	Vitamin content			
Vitamin	A	B	C	D
Brand 1	4	2	2	2
Brand 2	2	2	4	6

If brand 1 costs sh 10 per kilogram and brand 2 cost sh 14 per kilogram, formulate a linear programming problem and solve by graphical method to minimize cost. 6marks

e) Give any four characteristics of operations research. 4marks

f) The following table gives activities of a construction project and duration

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration (Days)	20	25	10	12	6	10

Draw a network for the project and find the critical path 5marks

g)

Plant	W1	W2	W3	W4	Capacity
P1	8	6	10	10	19
P2	13	10	7	11	35
P3	9	5	4	6	44
Demand	30	42	19	27	

Find the initial basic feasible solution using

i. North –West Corner Method (NWCM) 3marks
ii. Least cost method 3marks

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) Explain the phases in operations research 6marks

b) Give a brief overview of the transportation model 4marks

c) A manufacturing company has a current transportation schedule which is being questioned by the board as to whether or not it is optimal. The company has three factories and five depots. The necessary data regarding cash (Ksh), factory capacities and depot requirements are given below.

	1	2	3	Depot requirements
A	5	4	8	800
B	3	5	4	900
C	8	7	4	400
D	6	2	3	600
Factory capacities	1100	900	700	

As the manager, determine the optimal cost 10marks

QUESTION THREE (20 MARKS)

a) Jobs A, B, and C are to be allocated to machines R, S, and T and the returns in thousands of shillings are shown in the table below. Each machine is to be allocated to one job for maximum profit.

Machine Job	R	S	T
A	8	6	10
B	11	9	6
C	4	7	5

i. Use Hungarian method to determine the optimal allocation 4marks

ii. What is the maximum profit 1mark

b) Briefly discuss sensitivity analysis 3marks

c) A chemical manufacturer processes two chemical, Arkon and Zenon, in varying proportions to produce three products A, B and C. He wishes to produce at least 150 units of A, 200 units of B and 60 units of C. Each ton of Arkon yields 3 of A, 5 of B and 3 of C. Each ton of Zenon yields 5 of A, 5 of B, and 1 of C. If Arkon costs $40 per ton and Zenon $50 per ton:

i. Advice the manufacturer how to minimize costs 8marks

ii. What are the imputed amounts of Zenon and Arkon? 2marks

iii. What are the shadow values of Zenon and Arkon? 2marks

QUESTION FOUR (20 MARKS)

a) Define network analysis 2marks

b) Outline four objectives of network analysis 4marks

c) A new pharmaceutical product is to be released on a deadline for which 44 days are left. The activities involved n the product launch with their interdependencies and probabilistic times for completion in days are shown in the table below.

	Time delays			
Activity	Predecessor	Optimistic	Most likely	Pessimistic
A	-	6	10	14
B	A	1	2	3
C	A	16	20	30
D	B	3	5	7
E	D	2	3	4
F	C	7	10	13
G	D	1	2	3
H	G	1	3	5
I	C, G	2	2	2
J	I	2	3	4
K	H	1	1	1
L	J,K	1	2	3

i. Calculate the expected time for each activity 4marks

ii. Draw a project network and fid the probability of completing the project on time

10marks