



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE
ENERGY AND BIO FUEL TECHNOLOGY**

COURSE CODE: REN 224

COURSE TITLE: OPERATIONS RESEARCH

DURATION: 2 HOURS

DATE: 28/07/2022

TIME: 2:00PM-4:00PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 5 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

QUESTION ONE (30 MARKS)

(a) Explain the following terms applied in Programme Evaluation Review Technique.

(i) activity

(ii) event

(6 marks)

(b) (i) Highlight FOUR types of Inventory control applied in Industry

(ii) List TWO advantages of Inventory control

(6 marks)

(c) (i) Describe the term “Two Person- zero sum game” as it is applied in Operations Research

(ii) Define a markov process

(iii) State TWO properties of the process in C(ii)

(6 marks)

(d)(i) With the aid of a graph, maximize $z = x_1 + x_2$

Subject to

$$x_1 + 2x_2 \leq 4$$

$$4x_1 + 2x_2 \leq 12$$

$$-x_1 + x_2 \leq 1$$

$$x_1 \geq 0, x_2 \geq 0$$

(ii) Explain the term “unbounded solution space” as it is applied in linear programming

(12 marks)

QUESTION TWO (20 MARKS)

(a)(i) Determine the optimal strategies for company Y and Z from the pay off matrix in Fig 1.

(ii) comment on the results obtained in (a) (i)

(8 marks)

		Z		
		I	II	III
Y	I	-2	14	-2
	II	-5	-6	-4
	III	-6	20	-8

Fig. 1

(b) Describe the stages of development of a solution in Operations Research .

(12 marks)

QUESTION THREE (20 MARKS)

(a) Highlight THREE types of costs in Inventory control

(9marks)

(b) Show that the *Economic Order Quantity, EOQ*, $Q = \sqrt{\frac{2PD}{HC}}$ where there is no reserve stock and

P = Preparation or set up cost; D = Annual production; H = Holding or Inventory carrying cost

C = Unit cost of material; Q = Order quantity

(11 marks)

QUESTION FOUR (20 MARKS)

(a) Construct the network for a road construction given the following information in Table 1:

(10 marks)

Table 1

ACTIVITY	IMMEDIATE PREDESOSOR
a	None
b	a
c	b
d	b
e	a
f	e
g	c, d
h	f
i	g, f
j	i
k	j
l	j
m	j
n	k
o	l
p	m
q	g, h
r	n, o, p, q
s	q

(b) A maintenance crew of TWO Engineers can repair Four Solar Panels per day, where a day is made up of 8 hours. Determine the probability that the service will be completed in Four hours. Take the service time distribution to be exponential.

(10 marks)

QUESTION FIVE (20 MARKS)

(a) A computer system can operate in two different modes. It remains in the same mode for an hour and switches to a different mode in the next hour according to the transition probability matrix, P where

$$P = \begin{bmatrix} 0.4 & 0.6 \\ 0.6 & 0.4 \end{bmatrix}$$

- (i) Determine the Two-step transition matrix
- (ii) Determine the probability matrix that the system will be in Mode I at 11.30 am, if it was in mode I at 8.30am

(10 marks)

(b) Ojwang's three children , Obama, Trump, and Castro want money from their father for personal expenses. Their father decides that they must earn the money. Therefore, he chose three chores for his children: cutting grass around the house, mopping the house and cleaning the family car. To avoid anticipated sibling competition, he asks them to submit individual secret bids for what they feel is fair pay for each of the three chores. Using the **HUNGARIAN** method, determine the least cost of all the assignments and apportion the jobs to each of the siblings.

(10 marks)

OJWANG'S ASSIGNMENT PROBLEM

	CUTTING GRASS	MOPPING THE HOUSE	CLEANING THE CAR
OBAMA	300	250	200
TRUMP	250	350	300
CASTRO	300	300	250