



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2020/2021 ACADEMIC YEAR**

**THIRD YEAR 2ND SEMESTER**  
**MAIN EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF SCIENCE AGRICULTURE**  
**ECONOMICS AND RESOURCE MANAGEMENT**

**COURSE CODE:** AEC 325  
**COURSE TITLE:** OPERATIONS RESEARCH

**DATE:** 12<sup>TH</sup> OCTOBER 2021

**TIME:** 9 – 11 AM

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**INSTRUCTIONS TO CANDIDATES**

Answer Question ONE and any other TWO Questions.

TIME: 2 Hours

This paper consists of 3 printed pages. Please Turn Over 

KIBU observes ZERO tolerance to examination cheating

### Question 1

- a) Describe the term "Two Person-Zero sum game" as is applied in Operations Research (3Marks)
- b) Define a Markov process and state its Two Properties (3Marks)
- c) Highlight four applications of Operations Research (4Marks)
- d) A farmer has recently acquired a 110 hectares piece of land. He has decided to grow Wheat and barley on that land. Due to the quality of the sun and the region's excellent climate, the entire production of Wheat and Barley can be sold. He wants to know how to plant each variety in the 110 hectares, given the costs, net profits and labor requirements according to the data shown below:

Variety	Cost (Price/Ha)	Net Profit (Price/Ha)	Man-days/Ha
Wheat	100	50	10
Barley	200	120	30

The farmer has a budget of US\$10,000 and availability of 1,200 man-days during the planning horizon. Find the optimal solution and the optimal value. (20 Marks)

### Question 2

- a) Explain the following terms used in operations research
- (i) Surplus variable (2 Marks)
- (ii) Basic variable (2 Marks)
- (iii) Transportation problem (2 Marks)
- b) Use the simplex method for the problem: (10 Marks)

$$\text{Maximize: } z = 2x_1 + 3x_2$$

$$\text{subject to: } x_1 + x_2 \leq 10$$

$$x_1 + x_2 \geq 20$$

$$x_1, x_2 \geq 0.$$

- c) State four assumptions about linear programming model (4 Marks)

**Question 3**

A company wishes to bottle 2 different drinks. It takes 2 hours to can one gross of drink A, and it takes 1 hour to label the cans. It takes 3 hours to bottle one gross of drink B, and it takes 4 hours to label the cans. The company makes a \$10 profit on one gross of drink A and a \$20 profit on one gross of drink B. Given that the bottling department has 20 hours available, and the labeling department has 15 hours available, find out how many gross of drink A and drink B must be packaged in order to maximize the profit. (20 Marks)

**Question 4**

A firm is considering replacement of a machine, whose cost price is Ksh 12,200, and the scrap value is Ksh 200. The running (maintenance and operating) costs are found from the experience to be as follows:

Year	1	2	3	4	5	6	7	8
Running cost (RS)	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced?

(20 Marks)

**Question 5**

A company makes desk organizers. The standard model requires 2 hours of the cutter's and one hour of the finisher's time. The deluxe model requires 1 hour of the cutter's time and 2 hours of the finisher's time. The cutter has 104 hour of time available for this work per month, while the finisher has 76 hours of time available for work. The standard model brings a profit of \$6 per unit, while the deluxe one brings a profit of \$11 per unit. The company, of course, wishes to make the most profit. Assuming they can sell whatever is made, how much of each model should be made in each month? (20 Marks)