

**W1-2-60-1-6**

## JOMO KENYATTA UNIVERSITY

**OF**

**AGRICULTURE AND TECHNOLOGY**

# University Examinations 2017/2018

**END OF SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF COMMERCE**

**HBC 2210 : OPERATIONS RESEARCH**

**DATE: APRIL 2018 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER**

**TWO QUESTIONS.**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**QUESTION ONE (30 MARKS)**

(a) Define operation research. [1 mark]

(b) Discuss five operations research techniques. [5 marks]

(c) Determine the feasible space for each of the following independent constants, given that : [6 marks]

(i) 

(ii) 

(d) Suppose that the company is willing to convert the initial $5 million to any other currency that will provide the highest rate of return. Modify the original model to determine which currency is best. [5 marks]

(e) What is a transportation model? Where is it used? [2 marks]

(f) Compare the starting solution obtained by the North West corner, least cost and Vogel methods for the model. [5 marks]

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | 1 | 2 | 6 |
| 2 | 1 | 5 | 7 |
| 2 | 4 | 3 | 7 |
| 5 | 5 | 10 |  |

(g) What is a network model? Give its scope. [5 marks]

(h) Differentiate between pure and mixed strategies as used in Operations Research.

[2 marks]

**QUESTION TWO (20 MARKS)**

(a) Discuss the five principal phases for implementing Operation Research in practice.

[10 marks]

(b) Two different products P1 and P2 can be manufactured by one or both of two different machines M1 and M2. The unit processing time of either product on either machine is the same. The daily capacity of machine M1 is 200 units (of either P1 or P2 or a mixture of both) and the daily capacity of machine M2 is 250 units. The shop supervisor wants to balance the products schedule of the two machines such that the total number of units produced on one machine is within 5 units of the number produced on the other. The profit per unit of P1 is $10, and that of P1 is $15. Set up the problem as an LP in equation form. [10 marks]

**QUESTION THREE (20 MARKS)**

The electric power plants with capacities of 25, 40 and 30 million kWh supply electricity to three cities. The maximum demands at the three cities are estimated at 30, 35 and 25 million kWh. The price per million kWh at the three cities is given in table 1.1: price/million kWh.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Plant** | **City** | | | |
|  | **1** | **2** | **3** |
| 1 | $600 | $700 | $400 |
| 2 | $320 | $300 | $350 |
| 3 | $500 | $480 | $450 |

During the month of August, there is a 20% increase in demand at each of the three cities, which can be met by purchasing electricity from another network at a premium rate of $1000 per million kWh. The network is not linked to City 3 however. The utility company wishes to determine the most economical plan for the distribution and purchase of additional energy:

(a) Formulate the problem as a transportation model.

(b) Determine an optimal distribution plan for the utility company.

(c) Determine the cost of the additional power purchased by each of the three cities.

[20 marks]

**QUESTION FOUR (20 MARKS)**

(a) Explain the Vogel Approximation Method (VAM) giving the steps involved. [10 marks]

(b) Discuss the two changes affecting optimality in Operations Research. [10 marks]

**QUESTION FIVE (20 MARKS)**

(a) Consider the following linear programming model:

Maximize z = 4x +14y

Subject to 2x + 7y + z = 21

7x + 2y + t= 21

x,y,z,t 0

Check the optimality and feasibility of the basic solution:

Basic variables = (y,t), inverse =  [10 marks]

(b) For the following LP, identify three alternative optimal basic solutions, and then write a general expression for all the nonbasic alternative optima comprising these three basic solutions:

Maximize z = x +2y + 3z

x + 2y + 3z 10

x + y 5

x 

x,y,z,0

[10 marks]