

**KABARAK UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**MAIN CAMPUS**

**SECOND SEMESTER, 2017 ACADEMIC YEAR**

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND ACTUARIAL SCIENCE**

**COMP 315: OPERATION RESEARCH**

**STREAM: YEAR THREE SEMESTER ONE TIME: 2 Hours**

**EXAMINATION SESSION: JULY DATE:** 2017

INSTRUCTIONS:

1. Question **ONE** is compulsory.
2. Attempt question **ONE** and any other **TWO**

**QUESTION ONE**

1. Briefly explain the phases of an operation research project. (6 Marks)
2. State the assumptions of linear programming. (6 Marks)
3. Explain the meaning of the following terms as used in Game Theory i) Saddle point ii) dominance iii) Pure Strategy iv) Two-person zero-sum game (4marks)
4. An automobile manufacture makes automobile and trucks in a factory that is divided into two shops. Shop A which performs the basic assembly operation must work 5 man-days on each truck but only two man-days on each automobile. Shop B which performs finishing operations must work 3man-days on each truck or automobile that it produces. Because of men and machine limitations, shop A has 180 man hours per week available and shop B has 135 man-days per week. If the manufacturer makes a profit of sh. 300 on each truck and sh. 200 on each automobile how many of each should be produced to maximize profit. Use simplex method. (10 Marks)
5. Grain Handlers Limited has three warehouses, W1, W2 and W3.The table below shows the inventories of rice in the three warehouses.

Warehouse **W1 W2 W3**

Inventory (bags) 260 168 172

The company is required to supply three of its companies **C1, C2,** and **C3** with rice. The requirements of the customers are as follows:

Customer **C1 C2 C3**

Requirement (bags) 280 120 200

The data below shows the cost of transporting one bag of rice from the warehouse to the customers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Transportation cost per bag (sh)** | | | |
|  |  | **Customer** | | |
|  |  | **C1** | **C2** | **C3** |
|  | **W1** | 100 | 80 | 120 |
| **Warehouse** | **W2** | 140 | 80 | 140 |
|  | **W3** | 160 | 120 | 140 |

**Required**

Using the north-west corner rule state the initial feasible solution (4 marks)

**QUESTION TWO**

1. State the assumptions of assignment models as used in operations research (4 marks)
2. Amani Engineering Works Ltd has a network of branches all over Kenya .The branches are used to service repair and install equipment for their clients .Currently, the Nairobi branch has four clients who require installation of equipment .Each client requires the services of one engineer. There are four engineers who are not engaged at the moment and can be assigned any one of the tasks .However, these engineers have to travel form different locations and the Nairobi branch has to meet their travel and subsistence allowances. The allowances vary from one engineer to another and according to the client the engineer has been assigned to work for. The table below shows the costs (in thousands of shillings) associated with each engineer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Client** | | | |
| **Engineers** | **1** | **2** | **3** | **4** |
| **A** | 37 | 27 | 34 | 21 |
| **B** | 57 | 22 | 79 | 34 |
| **C** | 22 | 25 | 61 | 45 |
| **D** | 39 | 42 | 54 | 43 |

**Required**

Assign engineers to clients order to minimize their total cost (10marks)

1. Determine the saddle point solution, the associated pure strategy and the value of the game for each of the following games. The payoffs are for player (6marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Player B** | | | |
|  | 3 | – 1 | 4 | 2 |
| **Player A** | – 1 | – 3 | –7 | 0 |
|  | 4 | –7 | 3 | –9 |

**QUESTION THREE**

a) Explain the difference between assignment and transportation problems (4marks)

b) State the assumptions made in solving a transportation problem (3marks)

c) Formulate the dual problem of the following given model; (3 marks)

Minimize,

Subject to

,

,

,

 ,



d) Use the Vogel’s Approximation method to solve the following transportation problem

(10marks)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **W1** | **W2** | **W3** | **W4** | **SUPPLY** |
| **P1** | 58 | 55 | 60 | 62 | **250** |
| **P2** | 78 | 65 | 73 | 70 | **370** |
| **P4** | 66 | 63 | 70 | 58 | **380** |
| **P4** | 68 | 70 | 72 | 67 | **260** |
| **DEMAND** | **190** | **310** | **410** | **270** | **1180** |

**QUESTION FOUR**

1. Explain the importance of sensitivity analysis in linear programming problems (2marks)
2. Describe the limitations of linear programming. (5 marks)
3. A company makes two products 1 and 2, each product requires time on two machines A and B. The specifications for each product are as follows:

# Product 1 Product 2

Processing time on machine A (hrs/unit) 2 2

Processing time on machine B (hrs/unit) 1 2

Material and labour cost (sh/unit) 14 15

Selling price (sh/unit) 16 18

Maximum possible sale (units) 130 150

The amount of time available on machine A is 360 hrs and on machine B is 260 hrs.

**Required,**

1. To list the objective functions and constraints (5 marks)
2. To graph the constraints and show the feasible region (5 marks)
3. The optimum solution (3 marks)

**QUESTION FIVE 20 MARKS**

1. What kind of decision making situations may be analyzed using PERT and CPM techniques? Hence or otherwise state the major similarities between PERT and CPM. Under what circumstances is CPM a better technique of project management than PERT? ( 5 marks)
2. The School of Business Kabarak University is considering to have a faculty development programme and has planned the following activities:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ACTIVITY** | **Preceding activity** | **ESTIMATED TIME IN WEEKS** | | |
|  |  | **Optimistic** | **Most likely** | **Pessimistic** |
| A | – | 2 | 4 | 12 |
| B | – | 10 | 12 | 26 |
| C | A | 4 | 5 | 6 |
| D | A | 10 | 15 | 20 |
| E | A | 7 | 8 | 9 |
| F | B, C | 6 | 6 | 6 |
| G | D | 3 | 4 | 5 |
| H | E,F,G | 6 | 6 | 6 |

**Required**

1. Draw the network for the project. (3marks)
2. Determine the critical path, critical activities and project duration (5marks)
3. If 30 weeks deadline is imposed, what is the probability that the project will be finished within the time limit? (4marks)
4. If the project manager wants to be 99% sure that the project is completed on schedule date, how many weeks before the present date should he start the project work? (3marks)