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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR THREE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF INFORMATION SCIENCE**

**COURSE CODE: COM 322**

**COURSE TITLE: COMPUTATIONAL TECHNIQUE OF OPERATIONS RESEARCH I**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 19/11/2020 TIME: 12.00-2.00 PM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of FOUR (4) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Define the following terms
2. A feasible solution
3. An infeasible solution
4. The feasible region
5. An optimal
6. A corner-point feasible (CPF) solution **[5 Marks]**
7. Define the term operation research **[2 Marks]**
8. Convert the following linear programming problem into standard form. **[4 Marks]**



Subject to 





 is unconstrained

1. Describe any four areas where operation research can be applied **[4 Marks]**
2. Solve the following transportation problem using the North West Corner **[6 Marks**]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B | C | Availability |
| I | 120 | 77 | 26 | 3 |
| II | 90 | 150 | 140 | 6 |
| III | 20 | 20 | 50 | 2 |
|  | 6 | 3 | 5 |  |

1. The KICOMI retail store stocks two types of shirts A and B, these are packed in attractive cardboard boxes. In one week the store can sell a maximum of 400 shirts of type A and a maximum of 300 shirts of type B. The storage capacity, however, is limited to a maximum of 600 of both types combined. Type A shirt fetches a profit of Kshs. 20/- per unit and type B a profit of Kshs. 50/- per unit. The store wants to establish how many of each type of shirt they need to stock per week in order to maximize their total profit. Formulate a mathematical model for this problem. **[8 Marks]**

**QUESTION TWO (20 MARKS)**

1. A patient consults a doctor to check on his ill health. The Doctor finds him to be having deficiency of two vitamins, A and D. The patient is advised to consume vitamins A and D regularly for some time so as to regain his health. The doctor prescribes tonics I and II, both of which contain vitamins A, and D in certain proportions. He is also advised to consume at least 40 units of vitamin A and 50 units of vitamin D Daily. Formulate the linear programming model that minimizes the cost of tonics. **[6 Marks]**
2. A manufacturer makes two products  and. The first requires 5 hours for processing, 3 hours for assembling and 4 hours for packaging. The second requires 2 hours for processing, 12 hours for assembling and 8 hours for packaging. The plant has 40 hours available for processing, 60 hours for assembling and 48 hours for packaging. The profit margin for is $7 and for it is $21. Express the data in equations and inequalities necessary to determine the output mix that will maximize profits  **[14 marks]**

**QUESTION THREE (20 MARKS)**

1. Discuss important assumptions made when formulating a linear programming model  **[7 Marks]**
2. A company produces two products A and B from two raw materials C and D. The following table provides the basic data.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Tons of raw material A | Tons of raw material B | Max daily available |
| Raw material C | 6 | 4 | 24 |
| Raw material D | 1 | 2 | 6 |
| Profit per ton (sh1000) | 5 | 4 |  |

A market survey indicates that the daily demand for B cannot exceed that of A by more than 1 ton. The maximum daily demand for B is 2 tons. The company wants to determine the optimum product mix for A and B that maximizes the daily profit.

1. Formulate a Linear Programming model for this scenario **[5 marks]**
2. By simplex method, find how many tons of each product the company needs to produce in order to make maximum profit **[8 Marks]**

**QUESTION FOUR** **(20 MARKS)**

1. A transportation problem is specified by the supply, demand and shipping cost of a power company.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| From | City 1 | City 2 | City 3 | City 4 | Supply |
| Plant 1 | 8 | 6 | 10 | 9 | 35 |
| Plant 2 | 9 | 12 | 13 | 7 | 50 |
| Plant 3 | 14 | 9 | 16 | 5 | 40 |
| Demand | 45 | 20 | 20 | 30 |  |

Use the above data to determine minimize cost using

1. Northwest corner Method
2. Vogel Method **[10 Marks]**
3. A company manufactures two products, X and Y by using three machines A, B, and C. Machine A has 4 hours of capacity available during the coming week. Similarly, the available capacity of machines B and C during the coming week is 24 hours and 35 hours respectively. One unit of product X requires one hour of Machine A, 3 hours of machine B and 10 hours of machine C. Similarly, one unit of product Y requires 1 hour, 8 hour and 7 hours of machines A, B and C respectively. When one unit of X is sold in the market, it yields a profit of shs.50/- per product and that of Y is shs.70/- per unit. Solve the problem by using graphical method to find the optimal product mix **[10 Marks]**

**QUESTION FIVE (20 MARKS)**

1. A company has 4 salesmen and 5 customers. The company has estimated the cost in dollars associated with assigning a particular salesman to a given specific client. These estimates are given in the table below

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Client | | | | | |
| Salesmen |  | 1 | 2 | 3 | 4 | 5 |
| A | 32 | 50 | 37 | 36 | 49 |
| B | 35 | 48 | 35 | 47 | 46 |
| C | 32 | 58 | 40 | 38 | 40 |
| D | 30 | 54 | 39 | 40 | 50 |

Determine who should be assigned which client and the minimum cost the company can incur **[10 Marks]**

1. Describe in details the steps involved when solving a linear programming problem using the simplex method **[10 Marks]**