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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2018/2019 ACADEMIC YEAR THREE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: STA 214/ ECO 314**

**COURSE TITLE: OPERATION RESEARCH / QUANTITATIVE METHODS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 11/02/2020 TIME: 2.00-4.00 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 THREE (3) 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. Convert the following linear programming problem into standard form. **[4 Marks]**



Subject to 





 is unconstrained

1. A poultry farmer desires to purchase three specific feeds F1, F2 and F3 whose units cost per kg are 30, 15, and 40 respectively. The intention is to provide proper vitamin content while at the same time minimize the cost of feeding. The minimum vitamin content needed per feed mix are 35 and 50 units for vitamin A and B respectively; 1 kg of F1 contributes 3 units of A and a unit of B; 1 kg of F2 contributes one unit of A and 2 units of B; 1 kg of F3 contributes 4 units of A and four units of B. Formulate the underlying linear programming problem and solve it using simplex method. **[15 marks]**
2. A small group of Japanese Ladies gather together to make dolls. The dolls must be assembled A then clothed C before they are finally given some hair H. Being conscious of the competitive business climate the group knows that they must strive for efficiency.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| TASK | | | | |
| Lady |  | A | C | H |
| Lilo | 2 | 3 | 1 |
| Kumengo | 10 | 11 | 8 |
| Seesor | 9 | 5 | 3 |

Which lady should do which job in order to maximize their profit? **[6 marks]**

**QUESTION TWO**

1. 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]**
2. 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 and solve it using graphical method **[6 Marks]**

**QUESTION THREE**

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**

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 the minimum cost using

* + - 1. Northwest corner Method
      2. Minimum cost Method **[10 Marks]**

1. 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**

1. A company has 4 salesman 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]**