

**KENYA METHODIST UNIVERSITY**

**END OF 3RD TRIMESTER 2017 (FT) EXAMINATION**

**SCHOOL : SCIENCE AND TECHNOLOGY**

**DEPARTMENT : PURE AND APPLIED SCIENCES**

**UNIT CODE : MATH 330**

**UNIT TITLE : OPERATIONS RESEARCH FOR COMPUTER SCIENTIST**

**TIME : 2 HOURS**

**INSTRUCTIONS:**

* ***Answer question One and any other Two questions.***

**Question One**

1. Define operations research and provide a brief history of the same. (4 marks)
2. sate the fundamental theorem of duality (2 marks)
3. find the dual of the linear program (4 marks)

Minimize $z=20x+30y$

 Subject to: $2x+y\geq 80$

 $x+2y\geq 60$

 $x,y\geq 0$

d) Arrivals at a telephone booth are considered Poisson with an average time of 10 minutes between arrivals. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes.

 (i) What is the probability that a person arriving at the booth will have to wait? (4 marks)

(ii) What is the average length of the queues that form from time to time? (4 marks)

e) The following table gives the activities in a construction project and their related completion times. Draw a network diagram and determine the critical path (6 marks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| activity | 1-2 | 1-3 | 2-3 | 2-4 | 3-4 | 4-5 |
| Duration (days) | 20 | 25 | 10 | 12 | 6 | 10 |

f) Apply least cost method to solve the transport problem (6 marks)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  destinationsource | D | E | F | G | Supply |
| A | 1 | 5 | 3 | 4 | 100 |
| B | 4 | 2 | 2 | 5 | 60 |
| C | 3 | 1 | 2 | 4 | 120 |
| Demand | 70 | 50 | 100 | 60 |  |

**Question Two**

1. Explain the difference between the critical path method (CPM) and program evaluation and review technique (PERT) (4 marks)
2. A small project consisting of eight activities has the following characteristics

|  |  |  |
| --- | --- | --- |
|  |  | Time estimates in weeks |
| Activity | Preceding activity | Most optimistic | Most likely | Most pessimistic |
| A | None | 2 | 4 | 12 |
| B | None | 10 | 12 | 26 |
| C | A | 8 | 9 | 10 |
| D | A | 10 | 15 | 20 |
| E | A | 7 | 7.5 | 11 |
| F | B,C | 9 | 9 | 9 |
| G | D | 3 | 3.5 | 7 |
| H | E,F,G | 5 | 5 | 5 |

Required:

i) Draw the PERT network for the project (8 marks)

ii) Determine the critical path and project completion time (4 marks)

iii) Calculate the total floats for non-critical activities (4 marks)

**Question three**

1. State and explain three assumptions of linear programming. (6 marks)

b) Three products are processed through three different operations. The times in minutes required per unit of each product, the daily capacity of the operations (in minutes per day) and the profit per unit sold of each product (in Ksh) are given in the table:

|  |
| --- |
| TIME PER UNIT (MINUTES) |
| Operation | Product 1 | Product 2 | Product 3 | Operation capacity (min/day) |
| 1 | 1 | 2 | 1 | 430 |
| 2 | 3 | 0 | 2 | 460 |
| 3 | 1 | 4 | 0 | 420 |
| Profit/unit Ksh | 300 | 200 | 500 |  |

Required: Formulate a L.P governing this data and apply simplex method to find the maximum profit. (14 marks)

**Question four**

a) Distinguish between transportation and assignment models. (2 marks)

b) A departmental head has four workers and four tasks to be performed. His estimates of the times each worker would take to perform each task is given in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Worker |  |  |  |
| Task | I | II | III | IV |
| A | 8 | 26 | 17 | 11 |
| B | 13 | 28 | 4 | 26 |
| C | 38 | 19 | 18 | 15 |
| D | 19 | 26 | 24 | 10 |

Establish how the tasks should be allocated to workers so as to minimize the total man-hour. (8 marks)

c) Consider the transportation schedule below

|  |  |  |
| --- | --- | --- |
|  | Factories |  |
| Warehouses | A | B | C | Warehouse requirement |
| 1 | 50 | 40 | 80 | 400 |
| 2 | 80 | 70 | 40 | 400 |
| 3 | 60 | 70 | 60 | 500 |
| 4 | 60 | 60 | 60 | 400 |
| 5 | 30 | 50 | 40 | 800 |
| Factory supply capacity | 800 | 600 | 1100 |  |

Find the initial feasible solution using the Vogel’s approximation method (10 marks)