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**University Examinations 2016/2017**

FOURTH YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY.

**SMC 3255: OPERATIONS RESEARCH**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Define the following terms
2. Operation Research (1 mark)
3. Linear Programming (1 mark)
4. Simulation (1 mark)
5. Briefly explain four major components analysts consider when formulating a problem for OR study (4 marks)
6. Briefly explain three assumptions made in the transportation model. (3 marks)
7. Describe the steps taken in decision theory approach. (4 marks)
8. Briefly explain the following terms as used in network analysis model
9. PERT (Programme Evaluation and Review Technique) (2 marks)
10. CPM (Critical Path Method) (3 marks)
11. Workers from Mt. Kenya Industries are to be given special tools required to accomplish a particular task in the industry. The workers are served from a single counter of the tool room. The average time between two arrivals is 60 seconds. The arrivals are assumed to follow the poisson distribution. The average service time of the tool room attendant is 40 seconds. Using the queuing model, determine
12. Average queue length. (3 marks)
13. Average length of empty queue. (3 marks)
14. Express the following linear programming problem in standard form. (5 marks)

Maximize 

Subject to:



**QUESTION TWO (20 MARKS)**

1. A perfume is produced by four factories A, B, C and D. The unit production cost in them are sh. 2, sh 3, sh 1 and sh 5 respectively. The production capacities of these factories are factory A 50 units, B 70 units, C 30 units and D 50 units. These factories supply the perfume to four stores whose demands are 25, 35, 105 and 20 units respectively. The unit transport cost in shillings from each factory to each store is given in the table below.

 Store

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | 1 | 2 | 3 | 4 |
|  | A | 2 | 4 | 6 | 11 |
| factories | B | 10 | 8 | 7 | 5 |
|  | C | 13 | 3 | 9 | 12 |
|  | D | 4 | 6 | 8 | 3 |

1. Using Vogel method to determine the basic feasible solution. (8 marks)
2. Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimised. (6 marks)
3. State two limitations of a transportation model (2 marks)
4. Briefly explain the requirements of a linear programming problem. (4 marks)

**QUESTION THREE (20 MARKS)**

1. Kenya Breweries company manufacturers three types of beer namely; Tusker, Guinnes and White cap. The available data are given below such that x=Tusker, y=Guinnes and z=White cap. Determine using simplex method the product mix to maximize the profit.

|  |  |  |
| --- | --- | --- |
| operations | Time in hours required per unit of  | Total available hours per month |
| x | y | z |
| 1 | 1 | 2 | 2 | 200 |
| 2 | 2 | 1 | 1 | 220 |
| 3 | 3 | 1 | 2 | 180 |
| Profit/unit (shs) 10 15 8 |
| Minimum sales 10 20 30 required/month units |

 ` (12 marks)

b) Express the above LP problem in duality form (4 marks)

c) What are the assumptions made in LP problem? (4 marks)

**QUESTION FOUR (20 MARKS)**

1. Transit lorries arrive randomly at a stockyard with a mean of 8 lorries/hour. A crew of four men can unload a lorry in 6 minutes. Lorries waiting in queue to be unloaded are paid a waiting charge at a rate of sh 60 per hour. Men are paid a wage at a rate of sh 20 per hour. It is possible to augment the crew strength to 2 or 3 (of four men per crew) when the unloading time will be 4 minutes or 3 minutes respectively per lorry. Find the optimal crew size. (10 marks)
2. A project schedule has the following characteristics

|  |  |
| --- | --- |
| Activity  | Time (week) |
| 1-2 | 4 |
| 1-3 | 1 |
| 2-4 | 1 |
| 3-4 | 1 |
| 3-5 | 6 |
| 4-9 | 5 |
| 5-6 | 4 |
| 5-7 | 8 |
| 6-8 | 1 |
| 7-8 | 2 |
| 8-10 | 5 |
| 9-10 | 7 |

1. Construct the network (2 marks)
2. Compute E and L for each event (4 marks)
3. Find the critical path (4 marks)

**QUESTION FIVE (20 MARKS)**

A small garment making unit (firm) has five tailors stitching five different types of garments. All the five tailors are capable of stitching all the five types of garments. The output per day per tailor and the profit (shs) for each type of garment are given below:

|  |  |
| --- | --- |
| Tailor  |  Garment  |
| 1 | 2 | 3 | 4 | 5 |
| A | 7 | 9 | 4 | 8 | 6 |
| B | 4 | 9 | 5 | 7 | 8 |
| C | 8 | 5 | 2 | 9 | 8 |
| D | 6 | 5 | 8 | 10 | 10 |
| E | 7 | 8 | 10 | 9 | 9 |
| Profit sh per garment | 2 | 3 | 2 | 3 | 4 |

1. Which type of garment should be assigned to which tailor in order to maximize profit. (Assuming that there are no other constraints.) (10 marks)
2. If tailor D is absent for a specified period and no other substitute tailor is available, what should be the optimal assignment? (10 marks)