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**University Examinations 2015/2016**

SECOND YEAR, SECOND SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF COMMERCE AND SECOND YEAR, FIRST SEMESTER FOR THE DEGREE OF BACHELOR OF COOPERATIVE MANAGEMENT

**SMB 3425: OPERATIONS RESEARCH**

**DATE: November, 2015 TIME: HOURS**

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

**QUESTION ONE – (30 MARKS)**

1. (i) Briefly discuss three importance of Operation Research in business. (3 Marks)

(ii) A recreation department’s annual budget for supplies is $200,000. The ordering cost is $50 and holding cost is 20% of the value of the item. Find the EOQ, the optimal number of orders and the total inventory costs. (6 Marks)

1. (i) Arrivals at a telephone booth are considered to be poisson with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with a mean of 3 minutes. What is the probability that a person arriving at the booth will have to wait and for how long? (5 Marks)

(ii) A company has four salesmen who have to visit four clients. The profit records from previous visits are shown in the table below;

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Salesmen  Customers | A | B | C | D |
| 1  2  3  4 | 6  22  12  16 | 12  18  16  8 | 20  15  18  20 | 12  20  15  20 |

Required: Find the assignment plan that will maximize profits (5 Marks)

1. A firm has three shops with a total of 80 Television sets. An order is received from the local authority for 70 sets to be delivered to four schools. The unit transportation costs from the shops to the schools are shown below;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | Availability |
| I  II  III | 2  4  1 | 4  3  2 | 1  3  5 | 6  3  2 | 40  20  20 |
| Requirement | 20 | 30 | 15 | 5 |  |

Obtain an initial feasible solution for most economic delivery schedule using the least cost method. (5 Marks)

1. formulate the dual problem for the following primal problem

Max Z = 3

Such that;

= 6

and (6 Marks)

**QUESTION TWO (20 MARKS)**

1. State three assumptions of the Single queuing system. (3 Marks)
2. A self-service store employs cashier at its counter. Nine customers arrive on average every five minutes while the cashier can serve ten customers in five minutes. Assuming poisson distribution for arrival rate and negative exponential distribution for service rate, Find;
3. Average number of customers in the system (2 Marks)
4. The queue length (2 Marks)
5. The waiting time (2 Marks)
6. The traffic intensity (2 Marks)
7. Time a customer spends in the system. (2 Marks)
8. Meru town uses 100 replacement lamps a month for its street lights. Each lamp costs $ 8. Ordering costs are estimated at $ 27 per order and the holding costs are 25%. Currently, the lamps are ordered according to the EOQ. The supplier has however offered the town a 2% discount if they buy 600 lamps at a time. Should the town management accept the offer? (7 Marks)

**QUESTION THREE (20 MARKS)**

1. (i) Define the term linear programming. ( 1 Mark)

(ii) State two advantages of linear programming model in decision-making.(2 Marks)

(iii) Describe two characteristics of the linear programming model. (2 Marks)

1. Machine time available on two machines A and B is to be allocated to production of some quantity of two products 1 and 2. The two machines A and B have 80 hours and 60 hours of time available on them respectively. The two products 1 and 2 require different amounts of time on each of the machines as shown in the table below;

|  |  |  |
| --- | --- | --- |
| **Product** | **Time on machine A** | **Time on machine B** |
| 1  2 | 2 hours  4 hours | 3 hours  2 hours |

Each unit of product 1 is sold at Ksh. 60 and each unit of product 2 is sold at Ksh. 50

**Required:**

1. Formulate the above information as a linear programming problem. (5 Marks)
2. Using the simplex method, establish a production plan that will maximize the sales.

(8 Marks)

1. Find the maximum sales made. (2 Marks)

**QUESTION FOUR (20 MARKS)**

1. (i) By citing relevant examples, explain two areas in business where transportation model is applicable. (2 Marks)

(ii) Explain the objectives of the transport model. (2 Marks)

1. A firm of office equipment supplies has three depots located in various towns. It receives orders for 15 special filing cabinets from four customers. In total in the three depots, there are 15 of the current filing cabinets available and the management wishes to minimize delivery costs by dispatching the filing cabinets from the appropriate depot for each customer. Details of the availabilities, requirements and transport cost for filing cabinets are as given in the following table;

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Customer  Depot | Customer  A | Customer  B | Customer  C | Customer  D | Supply Capacity |
| X  y  Z | 13  17  18 | 11  14  18 | 15  12  15 | 20  13  12 | 2  6  7 |
| Demand | 3 | 3 | 4 | 5 |  |

Using Vogel’s approximation method, obtain a dispatch plan for the cabinets to the customers. (5 Marks)

1. (i) Write a brief history of Operation Research. (3 Marks)

(ii) The management style of trial and error is becoming less and less attractive. Discuss.

(2 Marks)

1. (i) State the main characteristic of the assignment model. (1 Mark)

(ii) A company employs service Engineers based at various locations throughout the country to service their equipments installed in the customers premises. Four requests for service have been received and the company finds that four engineers are available. The distance each of the engineers is from the various customers is given in the following table;

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Customers  Engineers | A | B | C | D |
| Albert  Benson  Collins  Daniel | 25  38  15  26 | 18  15  17  28 | 23  53  41  36 | 14  23  30  29 |

The company’s wish is to assign each Engineer to only one customer and minimize mileage. Establish an assignment plan that meets the wishes of the company. (4 Marks)

**QUESTION FIVE (20 MARKS)**

a) Explain the meaning of the following terms as used in the Network analysis;

(i) A critical Activity (1 Mark)

(ii) A critical Path (1 Mark)

b) A project consisting of eight activities has the following characteristics;

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

**Required:**

1. Draw the PERT network for the project. (6 Marks)
2. Determine the Critical Path. (2 Marks)
3. Prepare the activity schedule for the project. (8 Marks)
4. If a 30 weeks deadline is imposed, what is the likelyhood that the project will be completed on time? (2 Marks)