**ASSIGNMENT 5** 

**ADVANCED MATHEMATICAL MODELING FOR MANAGERIAL DECISIONS**

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Date: August 18, 2021



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**Indices:**

i : Nodes (i ∈ [1,21] , where i=1 corresponds to the company)

**Parameters:**

n : Number of farms

K : Capacity of the tanker (in Kilolitres)

Xi : East coordinate (x-coordinate) of the farms

Yi : North coordinate (y-coordinate) of the farms

Ri : Collection requirement for each visit (in Kilolitres)

Di : Frequency of milk collection from a farm,

1, if the milk has to be collected every day from the farm

0, if the milk has to be collected on alternate day from the farm

N : Number of nodes = n + 1

Lij : Length of Arc between i and j based on distance formula

(Defined set Arcs for all i,j such that i≠j and i,j ∈ Nodes)

**Variables:**

PR1ij : PR1ij = 1 if node j is visited directly from node i in route 1

PR2ij : PR2ij = 1 if node j is visited directly from node i in route 2

S1i : sequence of nodes in route 1, 0 for nodes not included in route 1

S2i : sequence of nodes in route 2, 0 for nodes not included in route 2

**Objective function:**

Minimize , where i,j ∈ Arcs

**Constraints:**

1. Each node which has to be visited daily should be a part of route 1 and route 2 and visited from only 1 node in each route
2. Each node which has to be visited on alternate days should be a part either route 1 or route 2 and visited from only 1 node in the respective route
3. Each node which has to be visited daily should be a part of route 1 and route 2 and only 1 node should be visited from it in each route
4. Each node which has to be visited on alternate days should be a part either route 1 or route 2 and only 1 node should be visited from it in the respective route
5. Indegree = Outdegree
6. Sequence of node 1 is 1 in both routes
7. If a node j is visited from node i in a route, sequence of node j should be higher than that of node i
8. Maximum value of sequence in a route = number of nodes included in the route
9. Sequence of nodes not included in the route should be 0
10. Collection requirement constraint

**Results:**

Total Tour length = 123.056 units

Route 1: 1 – 10 – 6 – 20 – 7 – 11 – 9 – 8 – 12 – 4 – 15 – 3 – 14 – 5 – 2

Route 2: 1 – 10 – 6 – 7 – 9 – 21 – 8 – 13 – 4 – 16 – 19 – 3 – 5 – 18 – 2 – 17