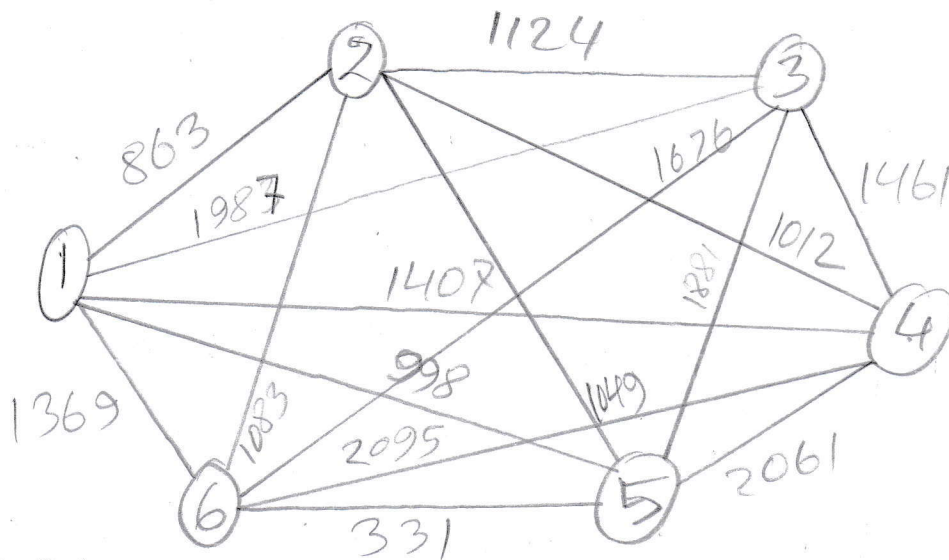Shyed Shahriar Housaini ; ID : MCE 079 0556

Problem Statement:-

Solve a simple TSP solution for your local region. Prepare cost matrix of 6 towns and proceed TSP solution with GA considering population size 4, cross over rate 100% and mutation rate 25%.

Solution:

TSP Distance cost matrix

	1	2	3	4	5	6
1	0	863	1987	1407	998	1369
2	863	0	1124	1012	1049	1083
3	1987	1124	0	1461	1881	1676
4	1407	1012	1461	0	2061	2095
5	998	1049	1881	2061	0	331
6	1369	1083	1676	2095	331	0

Fitness function for various chromosom/strings:-

For $\boxed{1|2|3|4|5|6}$ $= [D_{12} + D_{23} + D_{34} + D_{45} + D_{56} + D_{61}]$

$= [\cancel{863 + 1987 + 1407 + 998 + 1369}]$

$= [863 + 1124 + 1461 + 2061 + 331 + 1369]$

Fitness $= 7209$ Km.

For, $\boxed{2|6|3|4|5|1}$ $= [D_{26} + D_{63} + D_{34} + D_{45} + D_{51} + D_{12}]$

$= 1083 + 1676 + 1461 + 2061 + 998 + 863$

$= 8142$ km.

For $\boxed{3|6|4|1|2|5}$ Fitness $= 8971$ km..

For $\boxed{4|3|2|1|5|6}$ Fitness $= 6872$ km

For $\boxed{5|2|6|4|3|1}$ Fitness $= 8673$ km

For $\boxed{6|3|4|5|2|1}$ Fitness $= 8479$ km

Selection:

Parents 7209

| 1 | 2 | 3 | 4 | 5 | 6 |

Parents 8673

| 5 | 2 | 6 | 4 | 3 | 1 |

8971

| 3 | 6 | 4 | 1 | 2 | 5 |

8673

| 5 | 2 | 6 | 4 | 3 | 1 |

7209

| 1 | 2 | 3 | 4 | 5 | 6 |

8971

| 3 | 6 | 4 | 1 | 2 | 5 |

Mating pool

7209

| 1 | 2 | 3 | 4 | 5 | 6 |

6872

| 4 | 3 | 2 | 1 | 5 | 6 |

8673

| 5 | 2 | 6 | 4 | 3 | 1 |

6872

| 4 | 3 | 2 | 1 | 5 | 6 |

7209

| 1 | 2 | 3 | 4 | 5 | 6 |

6872

| 4 | 3 | 2 | 1 | 5 | 6 |

Parents 7993

| 4 | 1 | 3 | 2 | 5 | 6 |

Parents 6872

| 4 | 3 | 2 | 1 | 5 | 6 |

8479

| 6 | 3 | 4 | 5 | 2 | 1 |

6872

| 4 | 3 | 2 | 1 | 5 | 6 |

8142

| 2 | 6 | 3 | 4 | 5 | 1 |

6872

| 4 | 3 | 2 | 1 | 5 | 6 |

Crossover:

| 4 | 1 | 3 | 2 | 5 | 6 |

| 4 | 3 | 2 | 1 | 5 | 6 |

100% Crossover

①

| 4 | 4 | 3 | 1 | 5 | 6 |

| 4 | 3 | 3 | 2 | 5 | 6 |

Invalid Offsprings.

Finding Edge Table

| 4 | 1 | 3 | 2 | 5 | 6 | Parent 1

| 4 | 3 | 2 | 1 | 5 | 6 | Parent 2

Edge table

1	4	3	2	5	
2	-3	5	1		
3	1	-2	4		
4	1	3	-6		
5	2	-6	1		
6	-5	-4			

Using enhanced Edge Recombination
algorithm (choosing 4 as the first gene)
we get a new chromosom / string

| 4 | 6 | 5 | 1 | 3 | 2 |

Fitness = 7547 km

We have to eliminate
a gene from edge
table once we have
taken it into new

Mutation:

25% Mutation

$$\downarrow \quad \downarrow$$

4	1	3	2	5	6

Fitness = 7993 km

~~intercha~~ Interchanging in the chromosom string we get

4	3	1	2	5	6

with fitness of 7786 km which is less costly than the one ~~before~~ before mutation.

~~So, both~~ | 4 | 3 | 1 | 2 | 5 | 6 | ~~the~~

Least costly solution was | 4 | 3 | 2 | 1 | 5 | 6 | with fitness of 6872 km, after one cycle of run or after one generation, which was randomly selected.