546U4030 SOFT COMPUTING METHODS AND APPLICATIONS

Coding Assignment 6

ACO Based Optimization Systems for TSPs

Use programming tools (Visual Studio .Net) and other development tools (third party components) to development an ACO optimization system for traveling salesman problem. Particularly, you may implement AS, ACS, AS_rank, or Maxmin_AS. It is your own choice.

Conduct necessary system requirement analysis before implementing your system, to figure out the requirements of data structured and user interfaces for solving the TSP. You are given a library (.dll) and a set of TSP benchmarks. The class lab will instruct you how to use the library to take advantages of accessing and displaying a TSP benchmark. The system should have basic yet friendly user interfaces for benchmark problem selections, ACO parameter settings, and stopping condition settings, etc.

Travel Salesman Problems:

A travel salesman need to visit *n* cities exactly once for each city. The planar Cartesian coordinates of the cities are given and the Euclidean distances between cities can be computed accordingly. TSP is therefore, to find a sequence of city visits that has the shortest length (including the distance from the lastly sequenced city back to the first one).

n : number of cities

(x_i, y_i) : Cartesian coordinates of city i; $i = 0,1,\cdots,n-1$

$D = \left[d_{ij} \right]_{nxn}$

d_{ij} : distance from city i to city j

$d_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$

$\mathbf{G} = [g_0 g_1 \cdots g_{n-1}]; 0 \le g_i \le n-1; i = 0,1,\cdots,n-1; g_i \ne g_j, \forall i, j \in \{0,1,\cdots,n-1\} \wedge$

$\min f(\mathbf{G}) = d_{g_{n-1}g_0} + \sum_{i=0}^{n-2} d_{g_i g_{i+1}}$

The benchmarks for TSP are in extended file name “tsp”. Sample file:

NAME : att48	TSP Title
COMMENT : 48 capitals of the US	Comments
TYPE : TSP	TSP type (must be TSP)
DIMENSION : 48	Number of Objects (here city number *n*)
EDGE_WEIGHT_TYPE : ATT	From-to matrix type
NODE_COORD_SECTION	Coordinates of Nodes (here cities)
1 6734 1453	Node 1 ID, x coordinate (x_0), y coordinate (y_0)
2 2233 10	Node 2 ID, x coordinate (x_1), y coordinate(y_1)
:	
:	:

48 3023 1942	Node n ID, x coordinate (x_{n-1}), y coordinate(y_{n-1})
EOF	End of File token

The optimal solutions to TSP benchmarks are in extended file name "opt.tour". Note that the node IDs start from 1 to *n*; you must convert them to 0~*n*-1. Sample file:

NAME : att48	TSP Title
NAME : att48.opt.tour	File Name
COMMENT : Optimum solution for att48	Comments
TYPE : TOUR	Solution type (must be TOUR)
DIMENSION : 48	Number of Objects (here city number *n*)
TOUR_SECTION	Section for optimal route
1	Node ID at the 1st place of the sequence
8	Node ID at the 2nd place of the sequence
:	:
:	:
38	Node ID at the last place of the sequence
-1	Termination flag
EOF	End of File token