# Analysis

Input:

locations of n nodes with their coordinates

Job:

create a network topology(undirected graph) with following properties:

1. Contains all nodes
2. Degree of each vertex is at least 3
3. Diameter of the graph is at most 4(hop-distance)
4. Total cost of the network topology is as low as possible by the total geometric length of all links

Goal:

Implement two different heuristic algorithm(it does not have to guarantee the exact optimum)

E.g: Branch and Bound, Simulated Annealing, Greedy Local Search, Tabu Search, Genetic Algorithm

Creative ideas will be appreciated.

Two algorithms should be sufficiently different to compete in finding good solution.

Tasks:

* Describe the two algorithms.
* Provide reference to the source
* Provide pseudo code with sufficient comments
* Run the program on randomly generated examples(at least 5 examples), pick n random points in the plane, this can be done by generating random numbers in some range and taking them as coordinates, n >= 15
* show result(nodes` position) graphically.
* Draw some conclusion about how the two algorithms compare

Design

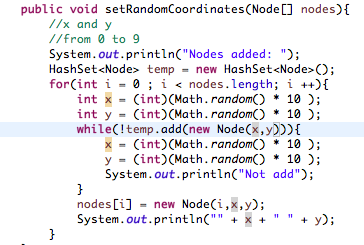
1.Given n nodes with coordinates

\* how to identify coordinates.

\* each node will have coordinate variables: x, y

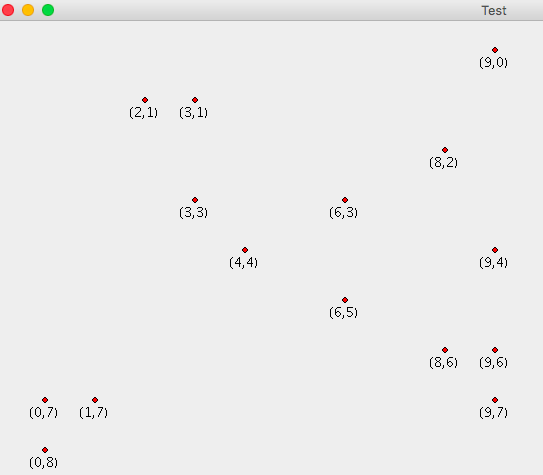
Create 15 nodes with random coordinates, and show them in the graph:

coordinates are in the range from 0 to 9,



Hashset is used to prevent coordinate duplication of each node, Swing and awt libraries are used to create coordinate system, and draw nodes





one random set of nodes created

Each time add one edge, then check degree , diameter to see if it meets the requirement.

Branch and Bound Algorithm

B : set of all n-dimensional binary vectors(all combinations)

f(x): maximum value over B



Bk(b) : subset of B which fixed the first k coordinates

when k = n, we fixed all the links , but also needs to meet the requirement that :

1. degree of each vertex in the graph >= 3

2. diameter of graph is at most 4

3. maximum would be : every vertex`s degree is 3, diameter is 4

Advantages:

1. easily construct a recursive algorithm to compute them.