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Homework 7 - CSCE 686

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**A) -**

For the vertex cover problem, the neighboring structure can be represented with a list of potential changes to the current set cover based on a k = 0 or 1 to 1 swap operator. Each element in the list would be another list with two parameters. The first parameter would be which vertex was being added to the current vertex cover. The second parameter would be null if it was a 0 to 1 swap or would be a vertex in the current vertex cover which is being swapped out.

Yes this representation can be applied for MIS problem because the minimum vertex cover for any graph is the complement of the maximum independent set for that same graph.

Every element in the neighborhood can be evaluated for MIS with an objective function which calculates the amount of nodes not in the vertex cover.

<https://www.geeksforgeeks.org/vertex-cover-problem-set-1-introduction-approximate-algorithm-2/>

**B) -**

From Talbi’s algorithm for simulated annealing,

Let s be the current set cover

While T > 0

Loop x times where x = the amount of neighbors/2

At random choose one of the items in the neighboring structure described in part A to be s’

Let the objective function f(s) be the amount of nodes in the vertex cover if the move s occurs

If f(s’) <= f(s), accept f(s’)

Otherwise, accept f(s’) with probability e^((f(s’)-f(s))/T) where T is given by the amount of vertices - the amount of times the loop has occurred.

T = T - 1

**C) -**

Least severe representation - Each point in the tabu list is represented by the customer that was moved, the route which it was moved from, and the route which it was moved to. From the current point, the last move can be reversed. This can continuously happen until the tabu list is empty.

More severe representation - Each point in the tabu list is represented by the nodes that are in every route but does not include the optimal path found for each set of nodes. It is assumed that the optimal path for every route can be found again.

Most severe representation - Each point in the tabu list is represented by the full list of every route.

**D) -**

I will be describing a swap based tabu search for the maximum independent set problem. First pick the node with the least amount of edges and add that to the MIS. After the tabu search will use a k to 1 swap operator where it removes a k amount of nodes from the MIS and adds 1 node that is not currently in the MIS. At first, do as many k=0 to 1 swap moves based on the current MIS to increase the cardinality. When this can not be done any longer, do k=1 to 1 swaps so the cardinality remains unchanged but other solutions can be searched for from the new MIS which could improve the cardinality. The last potential move is a k>=2 to 1 swap which will temporarily decrease the cardinality but could lead to solution with a greater cardinality than the current one. This is the step which could move from a local optima to a worst point in search for a better optima.

<http://www.info.univ-angers.fr/pub/hao/papers/JinHaoEAAI2014.pdf>