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HW7 – CSCE686

1. *Talbi #2.3 “VCP - Neighborhood”*

Yes, we can apply the proposed solution to the independent set problem.   
We can start with a state represented by a set of vertices that have included in into the partial solution. A method can be defined to find the neighbors of the current state. This can be accomplished by adding a valid vertex to the current stat or removing a vertex from the current state. Then the neighbors are able to be solved incrementally. This can be done by taking the neighbor and adding one to the cost if a vertex is added, and subtraction of one if vertex is removed. The VCP solution can be complemented to give the ISP solution.

1. *How would you use the neighborhood of question a) to solve the VCP using Simulated Annealing?*

This neighborhood representation structure can be used for a simple simulated annealing procedure to increase optimization To do this the algorithm can begin with two solutions, an initial solution and a secondary solution computed from a random neighbor. The cost of the secondary solution will be checked and if the cost is smaller than the initial solution then the secondary will take the place of the initial solution. But if the cost of the secondary solution is actually larger than the initial solution, the probability of a worse solution is computed to see which of the two solutions should be used.

1. *Talbi #2.19 “VRP - Tabu”*
2. Constant complexity. Customer ck in route Ri becomes the last customer in route Ri. For route Ri, the route now goes from customer Ck.
3. Linear complexity. Remove customer Ck from route Ri, so now route Ri is from customer Ck -1 to Ck +1. The route cost should now be computed again for Rj when Ck is between nodes Cn and Cn+1. Ck can now be put where it minimizes the Rj route cost.
4. Quadratic complexity. Remove customer Ck on route Ri. This route now is from customer Ck-1 to Ck+1. The route can now be recomputed to solve for the least cost to reach every customer node with a dynamic programming approach.

d. *Describe an algorithm possibility for your project or MIS, or SCP to be a local Tabu search. Relate to fitness landscape.*

Tabu search is a general heuristic procedure for guiding search to obtain good solutions in complex solution spaces*.* One of the main components of tabu search is its use of flexible memory, which plays an essential role in the search process. The maximal independent set problem, given a graph G = (V, E), aims to determine a subset S ⊆ V of maximum cardinality such that no two vertices of S are adjacent. We can describe a general swap based tabu search solve the MIS.

This tabu search first obtains a first feasible independent set S. From this initial solution, then the tabu search tries to find improved solutions with a series of steps based on a general (k, 1)-swap operator. One step is a (k, 1)-swap move (k = 0, 1) to increase the cardinality of the independent set or search new solutions while keeping the cardinality unchanged. Another step is to do a (k, 1)-swap move (k ≥ 2) to decrease temporarily the quality of the current solution.

References

1. General swap-based multiple neighborhood tabu search for the maximum independent set problem  
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