CSE 318 ASSIGNMENT-3 REPORT

Solving the Max-cut problem by GRASP

Introduction: The problem is a NP-hard problem. So it is hard to get the optimal solution. But we can go close to the optimal solution. The main objective of the assignment was to find two sets **S** and **S'** who are mutually non-intersecting so that the edges between these two cuts are maximum.

Steps:

1. First we have used a construction algorithm to construct a primary solution for S and S'.
2. For more fine tuning, we have used a local search algorithm.
3. The grasp method is combining these two algos. And after multiple iterations (in our case 50), we take the best output of GRASP.

Construction Algorithms & Their Details:

1. Greedy: Greedy is the most common approach. We have taken the maximum weighted edge and included the two vertices of the edge to X & Y sets. Then after calculating sigma_x and sigma_y, we have included the leftover vertices to these two sets. And in every case, we have taken the maximum one.

2. Semi-Greedy: Semi-Greedy is from the name as we can understand is a version of greedy. But unlike Greedy, this algo takes a restricted list and takes a random edge. The restricted list has more than a specific weight but not necessarily the restricted list members have to be the maximum weighted edges unlike Greedy.

3. Randomised: Here, we have taken an edge whose vertices are not yet assigned in S or S' and then randomly selected S or S' and assigned them to that set.

Results:

The Results of all 54 graphs are available in "Output_Report.csv".

Results Analysis:

If we analyse the results, we get in general that the greedy construction method gives better results than the other two construction methods (Randomised & Semi-greedy). Semi-greedy gives quite similar results to greedy but greedy is a bit better. And Randomised as expected gives the worst results. And after applying local search on the constructed S and S' with greedy method we get closer to the best max cut known so far. For G1, Greedy-1 gives 11270 , Semi-greedy-1 gives 11143, Randomised gives 9590. And we apply the local search on the greedy applied construction. With 28 average iterations , we get 11324. And after 50 iterations of grasp, we get 11415 which is (12078-11415) or 663 less than the best answer known so far. We are 5.48% short of the best answer known so far.

Conclusion & Discussion:

Greedy is the best possible construction method in our data. Local search improves the answer. If we increase the iteration of GRASP, we are sure to get a more accurate answer. Also a good construction algorithm also may help in accuracy. Greedy with local search is a better method

Graph To visualise: