

CSE 318 - Max Cut

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1 Introduction

1.1 Randomized

In this approach, each vertex is randomly assigned to one of the sets. The probability of being assigned is 0.5. We run the randomized algorithm for 100 iterations and calculate the average result. However, this approach tends to perform poorly on most of the datasets.

1.2 Greedy

The algorithm begins by assigning a single vertex to each partition, labeled as X and Y. Initially, both partitions, X and Y, are empty. These assignments are performed to ensure that each partition includes an endpoint of an edge with one of the highest weights. Following this, the remaining $|V| - 2$ vertices are considered individually to determine the optimal placement of each vertex into either partition. This decision is based on the criterion of maximizing the weight of the partial cut that is progressively being constructed. During each iteration, precisely one vertex is designated to be part of either the X or Y set.

1.3 Semi-Greedy

Instead of always selecting the edge with the maximum weight, a threshold value is calculated based on the minimum and maximum edge weights, along with a parameter α for the remaining graph. A random edge is then chosen among those edges with weights greater than the threshold. This approach yields promising results on the given dataset.

1.4 Local Search

The solution obtained through the semi-greedy approach might not be optimal. Hence, a local search is conducted on the solution. In each step, a vertex is selected, and its set assignment is changed if it enhances the max cut. This approach consistently outperforms the semi-greedy approach in all cases.

| 1 | | | | | | | local | local | | | |
|----|------|------|-------|---------|--------|-------------|-----------|--------|-----------|-------|-------|
| | Name | n | m | random | greedy | semi-greedy | search | search | GRASP | GRASP | Best |
| | | | | | | | Iteration | avg | Iteration | Value | |
| 2 | g11 | 800 | 1600 | 16.38 | 482 | 418.44 | 449.32 | 100 | 478 | 100 | 627 |
| 3 | g12 | 800 | 1600 | -0.86 | 478 | 401.29 | 432.67 | 100 | 457 | 100 | 621 |
| 4 | g13 | 800 | 1600 | 15.28 | 494 | 426.11 | 460.72 | 100 | 496 | 100 | 645 |
| 5 | g14 | 800 | 4694 | 2354.78 | 2940 | 2934.45 | 2965.7 | 100 | 2987 | 100 | 3187 |
| 6 | g15 | 800 | 4661 | 2330 | 2917 | 2914.34 | 2946.38 | 100 | 2972 | 100 | 3169 |
| 7 | g16 | 800 | 4672 | 2336.63 | 2901 | 2917.37 | 2950.01 | 100 | 2971 | 100 | 3172 |
| 8 | g1 | 800 | 19176 | 9570.21 | 11275 | 11103.1 | 11361 | 100 | 11482 | 100 | 12078 |
| 9 | g22 | 2000 | 19990 | 9986.39 | 12807 | 12628.5 | 12883.7 | 100 | 12980 | 100 | 14123 |
| 10 | g23 | 2000 | 19990 | 9991.75 | 12777 | 12619.7 | 12885.3 | 100 | 12964 | 100 | 14129 |
| 11 | g24 | 2000 | 19990 | 9987.51 | 12786 | 12622.9 | 12881.6 | 100 | 12985 | 100 | 14131 |
| 12 | g2 | 800 | 19176 | 9582.8 | 11243 | 11105.5 | 11368 | 100 | 11441 | 100 | 12084 |
| 13 | g32 | 2000 | 4000 | 8.68 | 1182 | 1026 | 1106.12 | 100 | 1150 | 100 | 1560 |
| 14 | g33 | 2000 | 4000 | -17.74 | 1162 | 996.07 | 1077.22 | 100 | 1115 | 100 | 1537 |
| 15 | g34 | 2000 | 4000 | -24.46 | 1184 | 990.23 | 1075.32 | 100 | 1115 | 100 | 1541 |
| 16 | g35 | 2000 | 11778 | 5891.25 | 7370 | 7360.4 | 7438.37 | 100 | 7481 | 100 | 8000 |
| 17 | g36 | 2000 | 11766 | 5881.86 | 7384 | 7349.27 | 7429.72 | 100 | 7470 | 100 | 7996 |
| 18 | g37 | 2000 | 11785 | 5899.78 | 7385 | 7359.12 | 7439.84 | 100 | 7475 | 100 | 8009 |
| 19 | g3 | 800 | 19176 | 9587.78 | 11292 | 11102.2 | 11359.6 | 100 | 11456 | 100 | 12077 |
| 20 | g43 | 1000 | 9990 | 4996.94 | 6380 | 6299.1 | 6432.82 | 100 | 6510 | 100 | 7027 |
| 21 | g44 | 1000 | 9990 | 4996.79 | 6386 | 6291.8 | 6427.48 | 100 | 6499 | 100 | 7022 |
| 22 | g45 | 1000 | 9990 | 4992.46 | 6341 | 6284.91 | 6426.28 | 100 | 6496 | 100 | 70202 |
| 23 | g48 | 3000 | 6000 | 3003.72 | 6000 | 5707.98 | 5713.4 | 100 | 6000 | 100 | 5988 |
| 24 | g49 | 3000 | 6000 | 3003.04 | 6000 | 5699.6 | 5705.1 | 100 | 5940 | 100 | 6000 |
| 25 | g50 | 3000 | 6000 | 2997.66 | 5880 | 5694.63 | 5699.33 | 100 | 5830 | 100 | 5988 |

Figure 1: Enter Caption

1.5 GRASP

In the GRASP approach, local search is performed for 100 iterations, and the best value achieved during these iterations is taken as the maximum cut. GRASP

2 Report

Here is the brief report. Full report is attached