

Assignment 2: Approximation Algorithms

Name: Xueyang Wang

Student ID: a1690260

1. Introduction

The work is written in matlab and have 4 files: runscript.m, Greedy.m, MaximalMatching.m and improvedGreedy.m.

runscript.m is a script that run all the three algorithm and generate the result and figures.

Greedy.m is a function implement Greedy algorithm.

MaximalMatching.m is a function implement 2-approximation algorithm.

improvedGreedy is a function that implement the algorithm that designed by myself.

All the functions that take three parameters as input: n , e , u and give three output: vc , runtime, v . n is the number of the nodes. e and u are the nodes of one edge, $Edge(e,u)$. vc is the size of the min vertex cover found by the algorithm. runtime is the running time of this algorithm. v is the min vertex cover found by the algorithm.

2. Run step

To get the result. Just extract the zip file and run runscript.m and two figures will show up and a result.xls will be generated. (Input file should be put into a folder under input folder. Eg: input\graph100\graph100-01.txt)

3. Design

The self-designed algorithm is based on the Greedy algorithm and add some 2-approximation ideas. First find the node that have the max degree then take a random edge which covered by this node then delete the edge from the graph and add the two node of the edge into the VC.

4. Comparison

Greedy algorithm: always get the best Min VC(vertex cover) and more time cost than 2-approximation and less than self-designed algorithm.

2-Approximation algorithm: at most time get the worst Min VC but sometimes better than self-designed algorithm. Time cost of this algorithm is the best (lowest). Because this algorithm take a edge by random, so sometimes the algorithm running good and sometimes running bad is not stable.

ImprovedGreedy algorithm: the Min VC is better than 2-Approximation algorithm at most time and cost the most time. The algorithm is designed by myself based on greedy and add some 2-approximation ideas into it.

In conclusion, the Greedy algorithm have the best result and running with a good time cost. 2-

Approximation algorithm running the worst result but with the lowest time cost. The self-designed algorithm running a good result but have the most time cost.

5. Result

Figure 1 shows the min VC of different files.

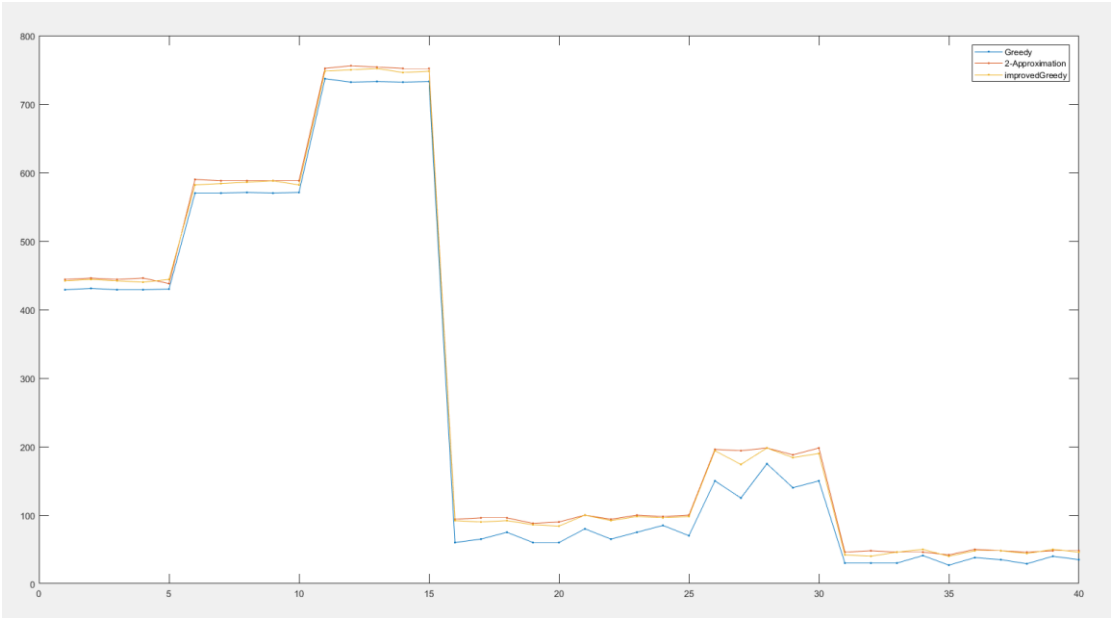


Figure 1

Figure 2 shows the running time of different files.

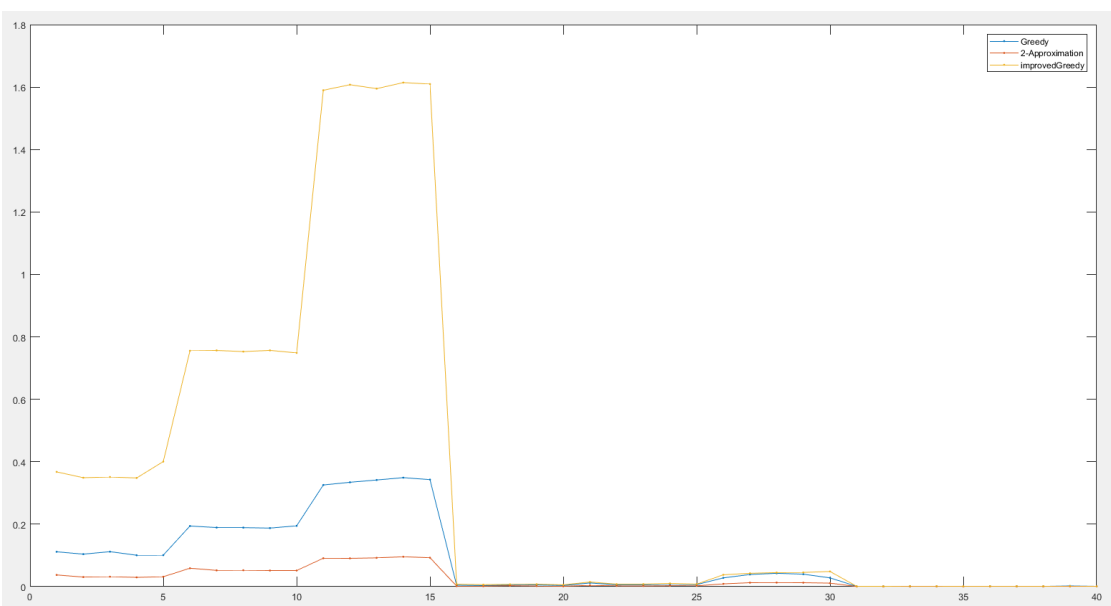


Figure 2

result.xls contains the data generate by different algorithm.

Filename	Greedy Min VC	Greedy Time (s)	2- Approximation Min VC	2-Approximation Time (s)	improved Greedy Min VC	improvedGreedy Time (s)
frb30-15-1.mis	429	0.1116728	444	0.0374533	442	0.3675916
frb30-15-2.mis	431	0.1041017	446	0.0307267	444	0.3489046
frb30-15-3.mis	429	0.1120375	444	0.0319031	442	0.351272
frb30-15-4.mis	429	0.1006239	446	0.0297473	440	0.3480453
frb30-15-5.mis	430	0.1009575	438	0.0317428	444	0.4006265
frb35-17-1.mis	570	0.1941513	590	0.0590079	582	0.755396
frb35-17-2.mis	570	0.1892914	588	0.052119	584	0.7565523
frb35-17-3.mis	571	0.189034	588	0.0525449	586	0.7528072
frb35-17-4.mis	570	0.1875328	588	0.0516275	588	0.7566944
frb35-17-5.mis	571	0.1948161	588	0.0515671	582	0.7485963
frb40-19-1.mis	737	0.325584	752	0.091012	748	1.5897892
frb40-19-2.mis	732	0.3342477	756	0.0907435	750	1.6075335
frb40-19-3.mis	733	0.341563	754	0.0921623	752	1.5949629
frb40-19-4.mis	732	0.3490523	752	0.0957589	746	1.6143703
frb40-19-5.mis	733	0.3427074	752	0.0925638	748	1.6095879
graph100-01.tx	60	0.0046723	94	0.0017973	92	0.0076555
graph100-02.tx	65	0.0034178	96	0.0015703	90	0.0063252
graph100-03.tx	75	0.0049495	96	0.0031908	92	0.0073346
graph100-04.tx	60	0.0054836	88	0.0021025	86	0.0077984
graph100-05.tx	60	0.0036645	90	0.0012115	84	0.0057019
graph100-06.tx	80	0.0117641	100	0.0042934	100	0.0149412
graph100-07.tx	65	0.0060335	94	0.0024925	92	0.0079453
graph100-08.tx	75	0.0058827	100	0.0021834	98	0.0081099
graph100-09.tx	85	0.0068202	98	0.0028446	96	0.0103592
graph100-10.tx	70	0.0066027	100	0.0026429	98	0.0081695
graph200-01.tx	150	0.0280814	196	0.0089219	194	0.0379136
graph200-02.tx	125	0.0388705	194	0.0126484	174	0.0427589
graph200-03.tx	175	0.0427534	198	0.0130305	198	0.0450196
graph200-04.tx	140	0.03993	188	0.0126018	184	0.0455522
graph200-05.tx	150	0.0281327	198	0.0112423	190	0.048593
graph50-01.txt	30	0.0008614	46	0.0005562	42	0.0011148
graph50-02.txt	30	0.0007931	48	0.000495	40	0.0010023
graph50-03.txt	30	0.001146	46	0.0006063	46	0.0018846
graph50-04.txt	41	0.001172	46	0.0008349	50	0.0016406
graph50-05.txt	27	0.0007398	42	0.0004473	40	0.0013532
graph50-06.txt	38	0.0015794	50	0.0007856	48	0.0015664
graph50-07.txt	35	0.0010576	48	0.0008961	48	0.0014314
graph50-08.txt	29	0.000947	46	0.000645	44	0.001367
graph50-09.txt	40	0.0023113	48	0.0008594	50	0.0020346
graph50-10.txt	35	0.0011744	48	0.0008515	46	0.0012537

result.xls