

MDM-2024 Homework N

Cuong Nguyen (101559968), Petteri Raita (909635),
and Raihan Gafur (101555441)

November 10, 2024

Contents

List of Figures

1 Improved Algorithm

The improved algorithm focuses on the selection of cliques based on the smallest degree nodes and uses a theorem to prune the search space efficiently.

The primary improvement lies in selecting cliques starting with nodes that have the smallest degree, $\deg(v)$, in the entire graph.

Theorem 1. *If*

$$f(S) < 1 - \frac{\deg(v)(1 - \alpha)}{(|S| - 1)\alpha}$$

for any $v \in S$, then none of S 's supersets can be an α -clique.

Pruning Mechanism Using Theorem The pruning mechanism is governed by a theorem that sets a condition on when a set S and its supersets can be classified as non- α -cliques. For effective pruning:

- The condition must hold more frequently.
- The upper bound on the right-hand side (RHS) of the theorem must be maximized.

Maximizing the RHS upper bound involves minimizing the negative term associated with $\deg(v)$. Therefore, iterating over nodes from the smallest to largest degree makes the pruning happen as often as possible.

Illustration A visual representation of the improvement is shown in Figure ???. In the graph, the differing values tested candidates per alpha, show the computation performance of the improved algorithm. For smaller alphas, the effect is more pronounced, but even for the alpha 0.8, the improved algorithm does 47 comparisons less. With alpha reaching 1, there is no difference with the improved and traditional algorithm. This happens, since the RHS of the theorem will become always 1.

The exact values of tested candidates per alpha are:

Alpha	Basic Algorithm	Improved Algorithm
0.5	1613	1471
0.6	1261	1127
0.7	1006	902
0.8	621	574

Impact of Graph Size on α For future research, the effect of the size of the graph might affect the number of candidates tested. Possibly, in larger graphs, the impact of the improved pruning algorithm, might save more tested candidates.

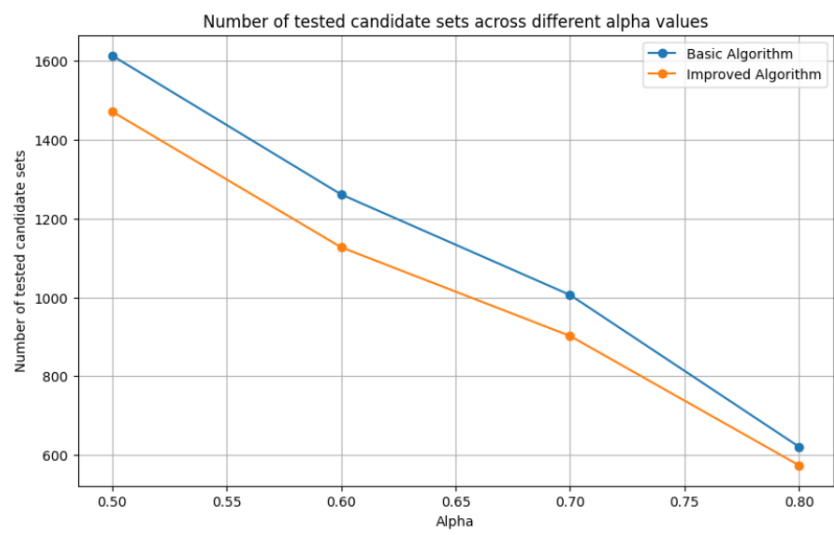


Figure 1: Different alphas