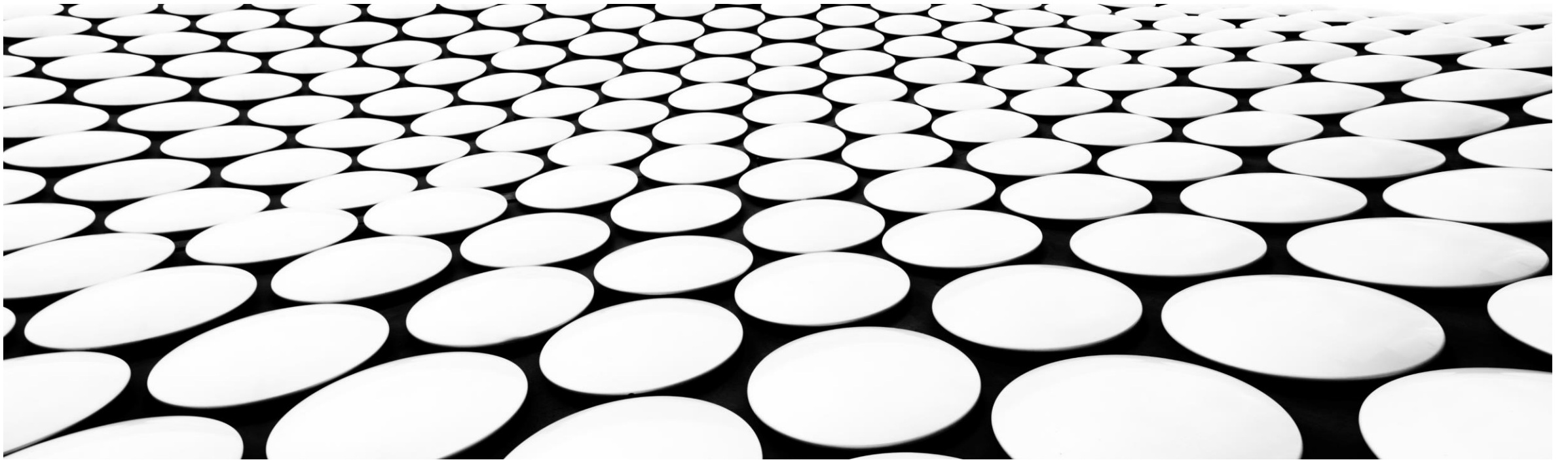
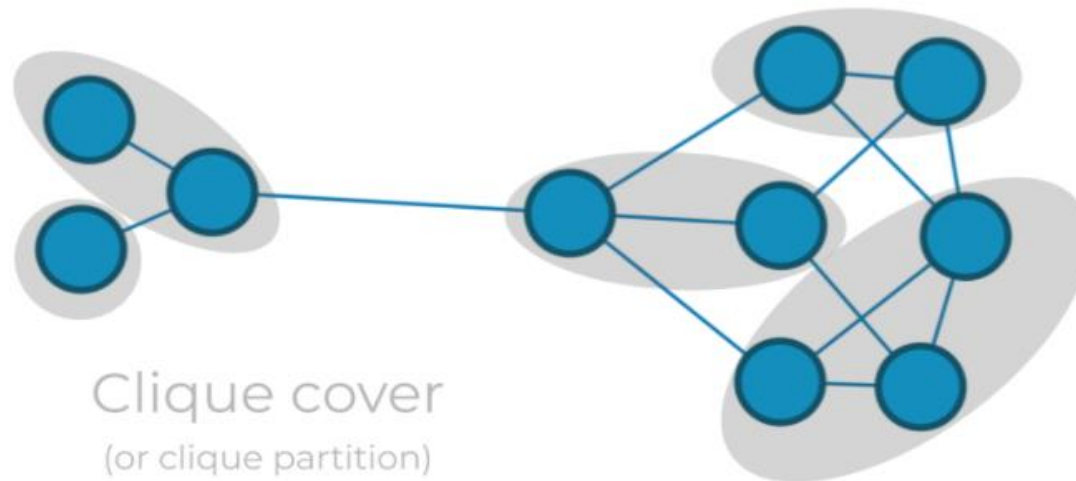

CLIQUE COVER



WHAT IS CLIQUE?

- A clique of an undirected graph G is a set X of vertices of G with the property that every pair of distinct vertices in X are adjacent in G .

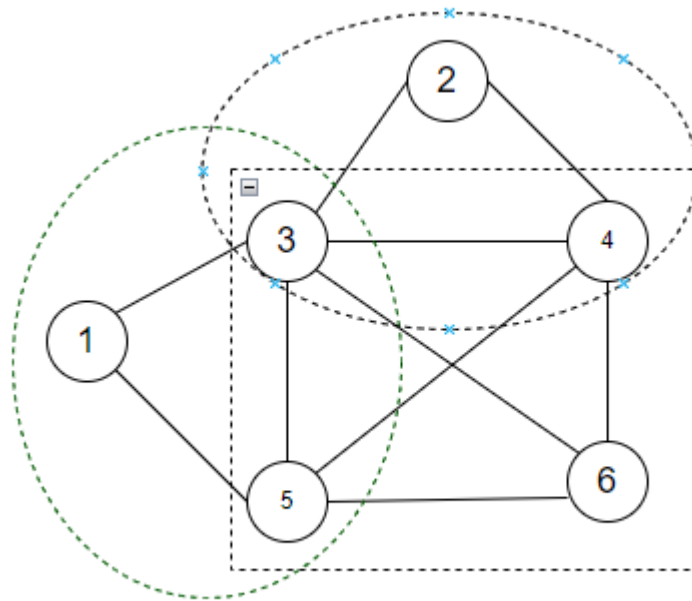


CLIQUE COVER

- In simple terms, finding a *clique cover* of a given undirected graph G means covering the graph with cliques, so that each vertex belongs to at least one clique.
- The *clique cover problem* asks whether a graph's vertices can be partitioned into k or fewer sets such that each set of vertices induces a clique.

MINIMUM CLIQUE COVER PROBLEM

- Finding a *minimum clique cover* means finding how to cover the graph with a **minimum number of cliques**
- The minimum **k** for which a clique cover exists is called the **clique cover number** of the given graph.



Clique cover number = 3

MINIMUM CLIQUE COVER FINDING ALGORITHM

- Minimum Clique Cover problem is an *NP-hard problem*, which basically means the optimal solution can't be solved in *polynomial time*.
- We used 3 different approaches to solve this problem
 - Brute force
 - Backtracking
 - Greedy

BRUTE FORCE APPROACH

- Exact algorithm
- Naive algorithm
- Trying all the possible combinations of cliques.

BACKTRACKING APPROACH

- Exact algorithm
- Improvement of the Brute Force algorithm
- It is able to stop its exploration of the solution if it is sure that there won't be any viable & better solution with the given configuration.
- The number of configurations tested is way smaller

GREEDY APPROACH

- Heuristic algorithm
- Improvement of the backtracking algorithm
- Determining which vertex belongs to which clique iteratively for the minimum clique cover

TIME COMPLEXITY

Brute Force	Backtracking	Greedy
$O(n^3 * n^n)$	$O(n^3 * n^n)$	$O(r * n^2)$

SPACE COMPLEXITY

Brute Force	Backtracking	Greedy
$O(n^2)$	$O(n^2)$	$O(n^2)$

CONCLUSION

- We have studied the Clique Cover problem throughout this term.
- We have implemented the minimum clique cover algorithm using 3 approaches and we tried to optimize it as much as possible.
- But we believe there are still many properties still left to be explored and it can be extended for future work



THANK YOU