

1 Clique Problem

- *Algorithm*: Finding maximum clique in a given graph (algo. 1)
- *Input*: An undirected graph with a set of vertices V and a set of edges E .
- *Complexity*: complexity of the algorithm, e.g. $\mathcal{O}(n)$
- *Data structure compatibility*: Undirected Graphs.
- *Common applications*: DNA computing, sociology studies, data mining.

Clique Problem

The clique problem is to find the maximum clique in a given undirected graph. A clique is defined as all nodes are connected to each other through an edge, namely a complete subgraph.

Description

Suppose we have an undirected graph with a set of vertices and a set of edges, we wish to find a fully connected subgraph with maximum nodes, which is known as a *maximum complete subgraph*. The input shall be the undirected graph.

We will introduce a basic algorithm used to solve the clique problem, called **B&B framework**. (Branch and Bound)

Algorithm 1: name

Input : A graph G

Output: Clique C

```
1 Function Main( $G$ ):  
    /*  $C^*$  is the current discovered maximum clique */  
2      $C^* \leftarrow \emptyset$ ;  
3     Clique( $C^*, \emptyset, V$ );  
4     return  $C^*$ ;  
5 end  
6 Function Clique(set  $C^*$ , set  $C$ , set  $P$ ):  
    /*  $C$  is clique,  $P$  is candidate vertex set */ /*  $|C|$  means the cardinality of  $C$  */  
7     if  $|C| > |C^*|$  then  
8          $C^* \leftarrow C$ ;  
9     end if  
10    if  $|C| + |P| > |C^*|$  then  
11        for  $p$  sorted with degree-ascending in  $P$  do  
12             $P \leftarrow P \setminus \{p\}$  ;  
13             $C' \leftarrow C \cup \{p\}$ ;  
14             $P' \leftarrow P \cap$  vertices adjacent to  $p$ ;  
15            Clique(set  $C^*$ , set  $C'$ , set  $P'$ ) ;  
16        end for  
17    end if  
18 end
```

References

- <http://www.cs.ecu.edu/karl/6420/spr16/Notes/NPcomplete/clique.html>
- Wikipedia is not acceptable if this is the unique reference
- Reference some books, or published articles
- Use reliable websites (no blog allowed) that are not likely to disappear any time soon