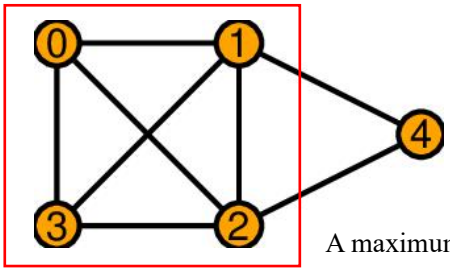
Parallel Maximum Clique Problem

Problem Descriptions:

Maximum Clique Problem (MCP) is a fundamental problem in graph theory. Given a graph G with V vertices and E undirected edges, the maximal clique is the largest subset of vertices in which each vertex is directly connected to every other vertex in the subset.



A maximum clique with 4 nodes.

What you need to do is to design and implement an efficient parallel MCP algorithm.

Input:

Graph represented in ***DIMACS ascii*** format. There is an example partially copied from the file:

https://iridia.ulb.ac.be/~fmascia/files/DIMACS/C125.9.clq.

The most important information of the input graph is in bold. **The indices of vertices start from 1.**

```
c FILE:  C125.9.clq
c
c SOURCE: Generated by Michael Trick using
c        ggen, a program by Craig Morgenstern
c
c DESCRIPTION: Cx.y is a random graph on x vertices
c            with edge probability .y
c
c
c G(n,p) graph
c graph gen seed     : 74328432
c number of vertices : 125
c max number of edges: 20000
c edge probability   : 0.900000
c data structure     : dense
c
c          Graph Stats
c number of vertices  : 125
c nonisolated vertices: 125
c number of edges     : 6963
c edge density        : 0.898452
c max degree          : 119
c avg degree          : 111.41
```

```
c min degree         : 102
p col 125 6963
e 2 1
e 3 1
e 4 1
e 4 2
e 4 3
e 5 1
e 5 2
e 5 3
e 5 4
e 6 1
e 6 2
e 6 3
e 6 4
e 6 5
e 7 1
e 7 2
e 7 3
e 7 4
e 7 5
e 7 6
…
```

Output:

Output the size (number of vertices) of the searched maximum clique, and output the number indices in the maximum clique.

Benchmark:

1. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/C125.9.clq
2. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/gen200_p0.9_44.clq
3. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/hamming8-4.clq
4. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/p_hat300-1.clq
5. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/brock400_4.clq
6. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/gen400_p0.9_55.clq
7. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/C500.9.clq
8. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/keller5.clq
9. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/p_hat700-1.clq
10. https://iridia.ulb.ac.be/~fmascia/files/DIMACS/brock800_4.clq