

# Distributed Algorithms 2022

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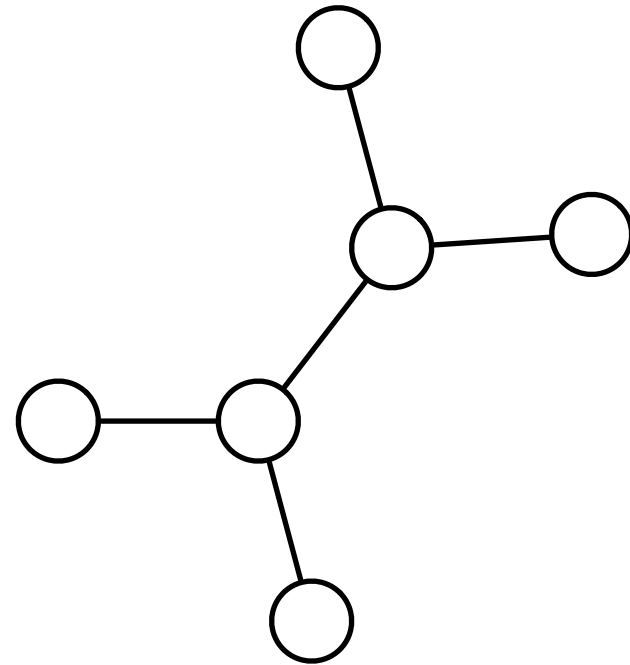
Graph-theoretic foundations

# Graphs in this course

- Defining:
  - models of distributed computing
  - what we want to solve
  - what are the assumptions
- Designing & analyzing algorithms
- Proving impossibility results
- Often: *graph  $\approx$  network, node  $\approx$  computer*

# Quiz

- Graph where maximal independent sets are never minimum dominating sets?



# Please do not confuse

- **Maximal**

- not a subset of another solution
- very easy to find: add greedily

- **Maximum**

- largest possible solution
- often hard to find

# Please do not confuse

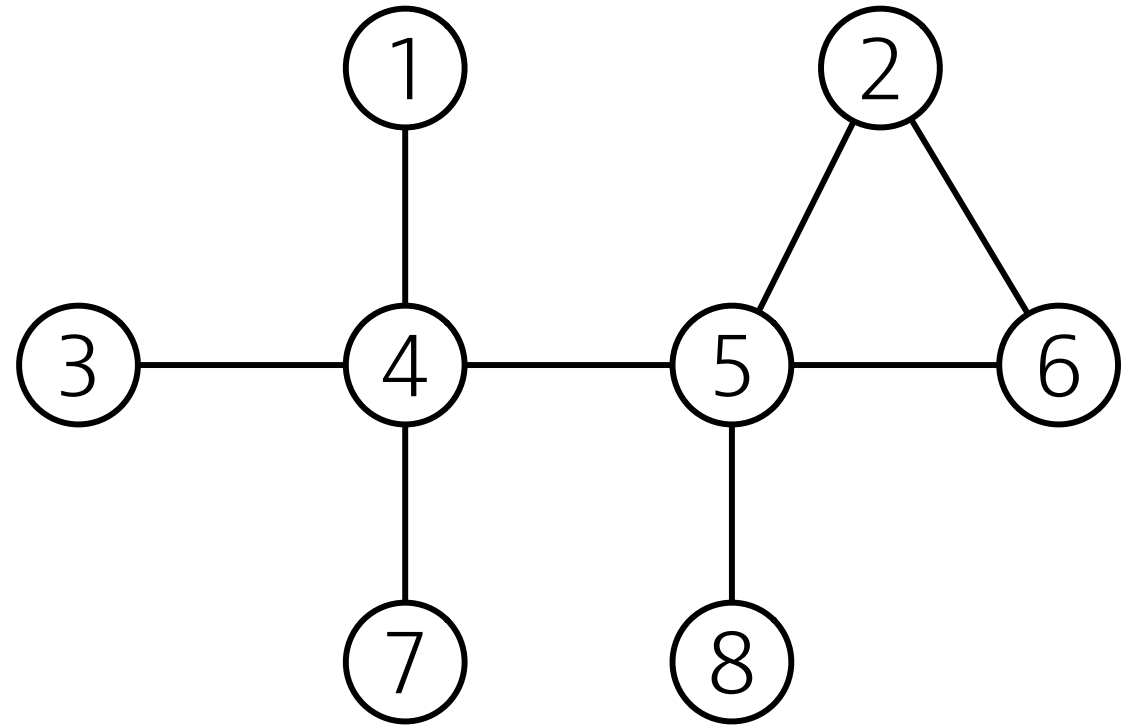
- **Minimal**

- not a superset of another solution
- very easy to find: remove greedily

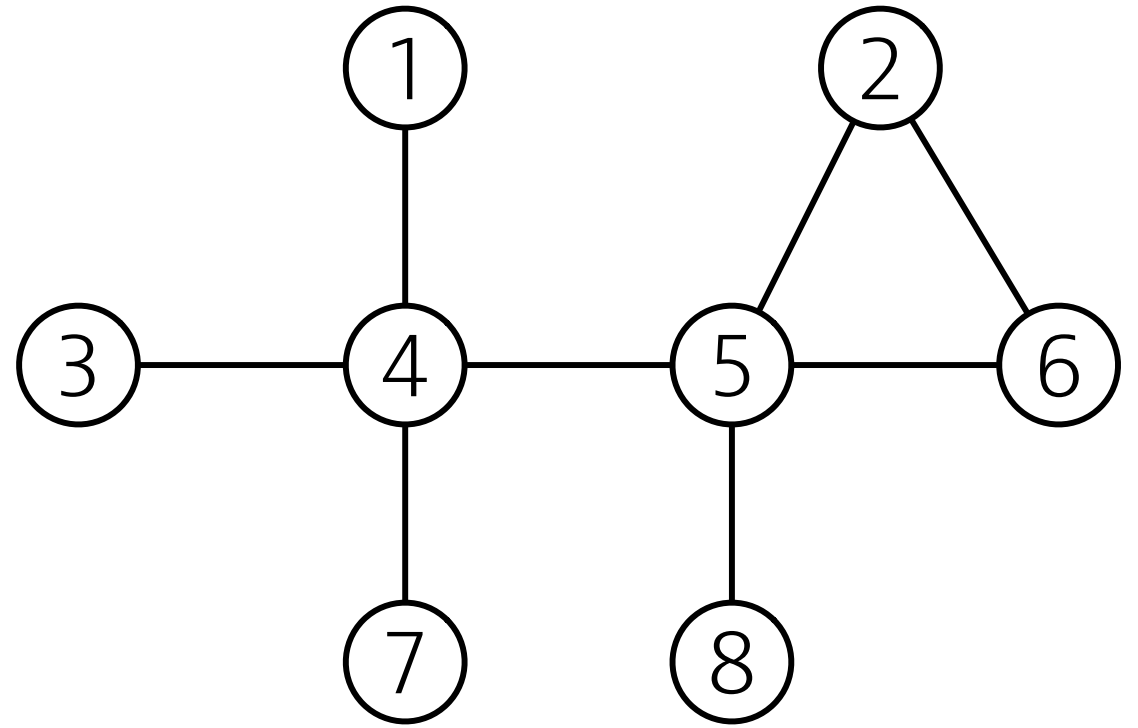
- **Minimum**

- smallest possible solution
- often hard to find

**Q & A**

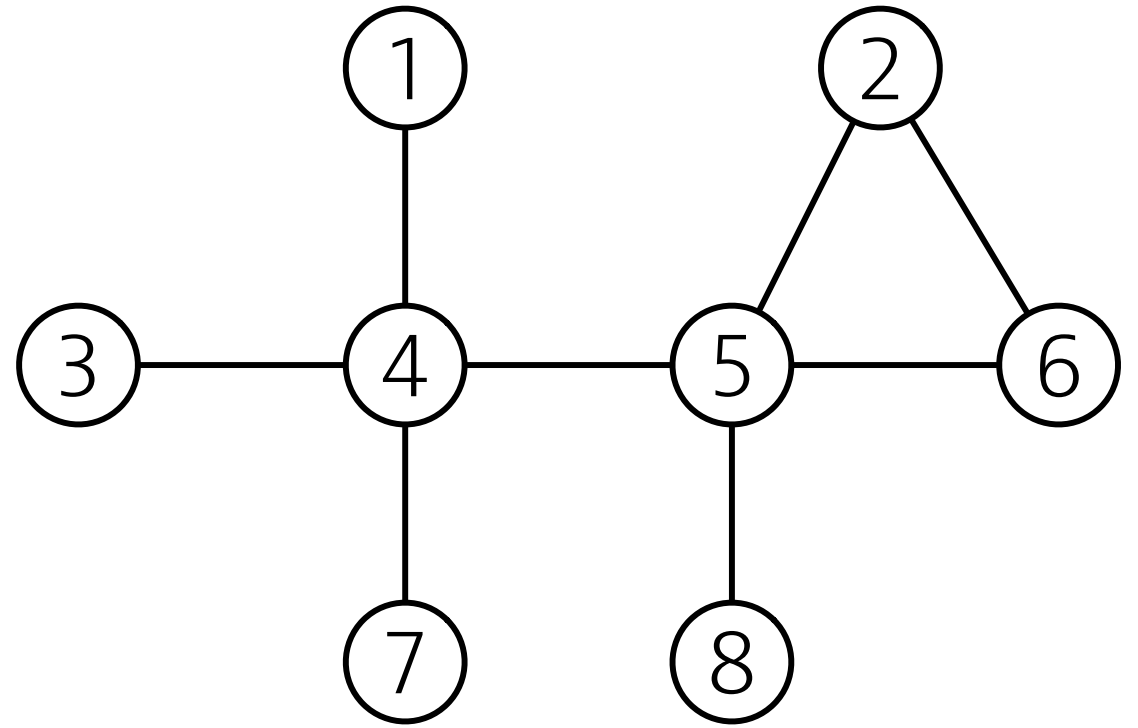


Minimum  
vertex cover



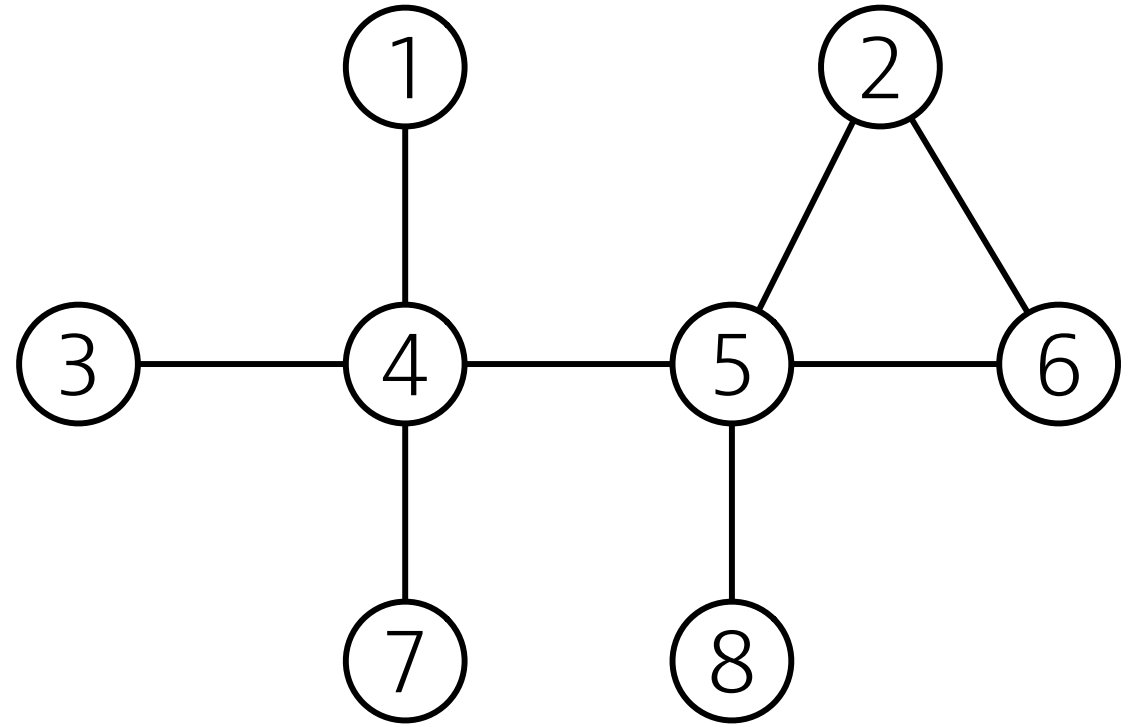
Minimum  
dominating set



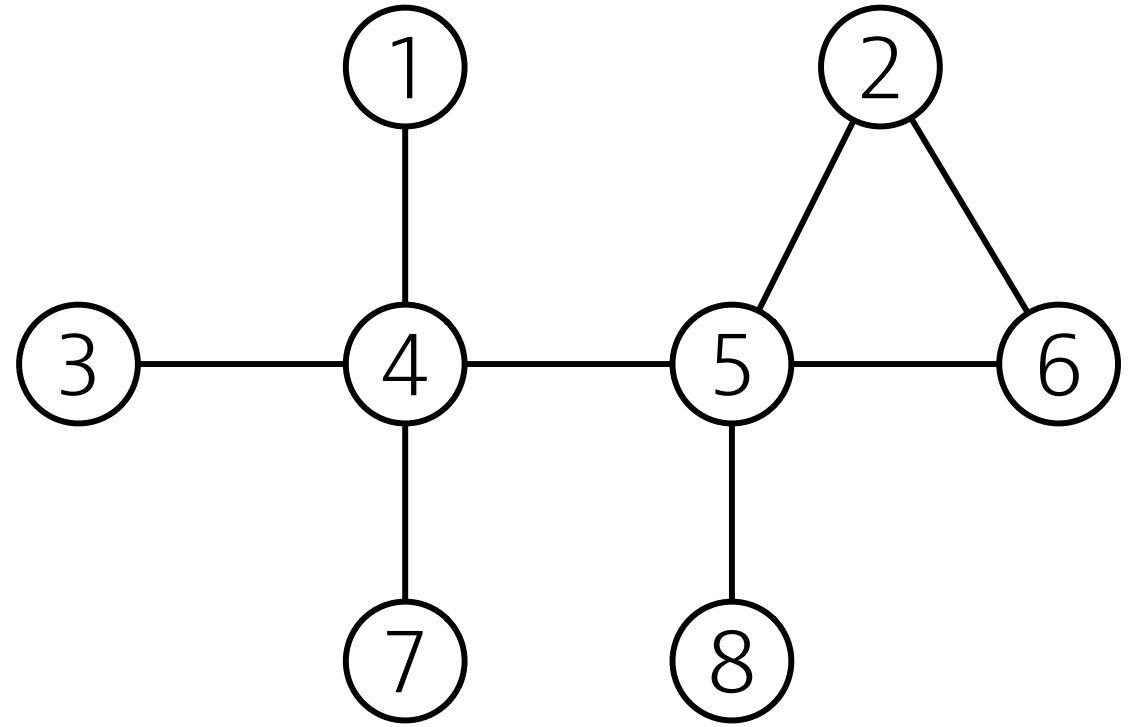


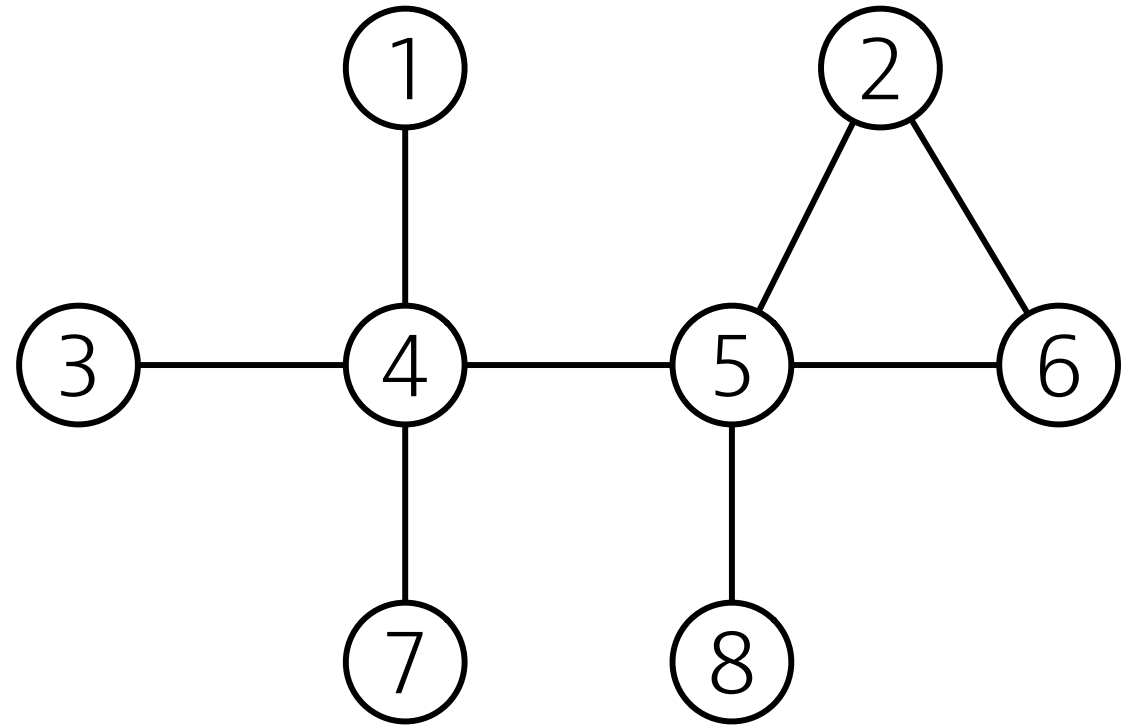
Maximum  
independent set

Smallest  
set of nodes  
that is both  
an independent set  
and a dominating set

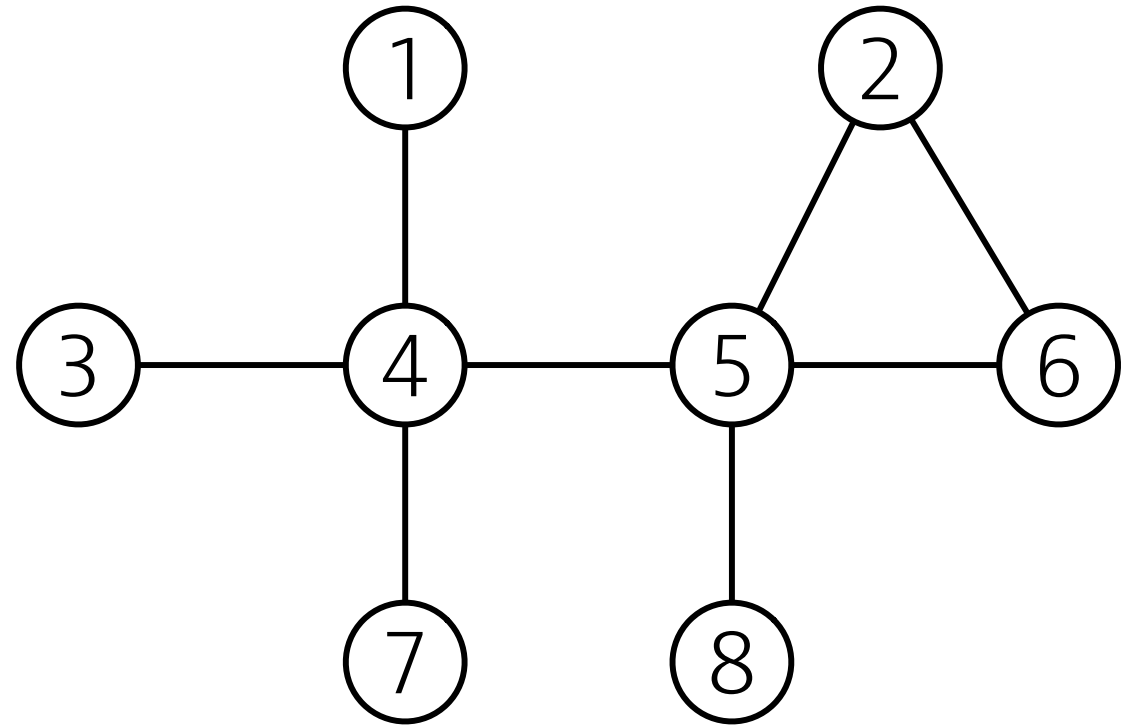


Largest  
set of nodes  
that is both  
an independent set  
and a dominating set

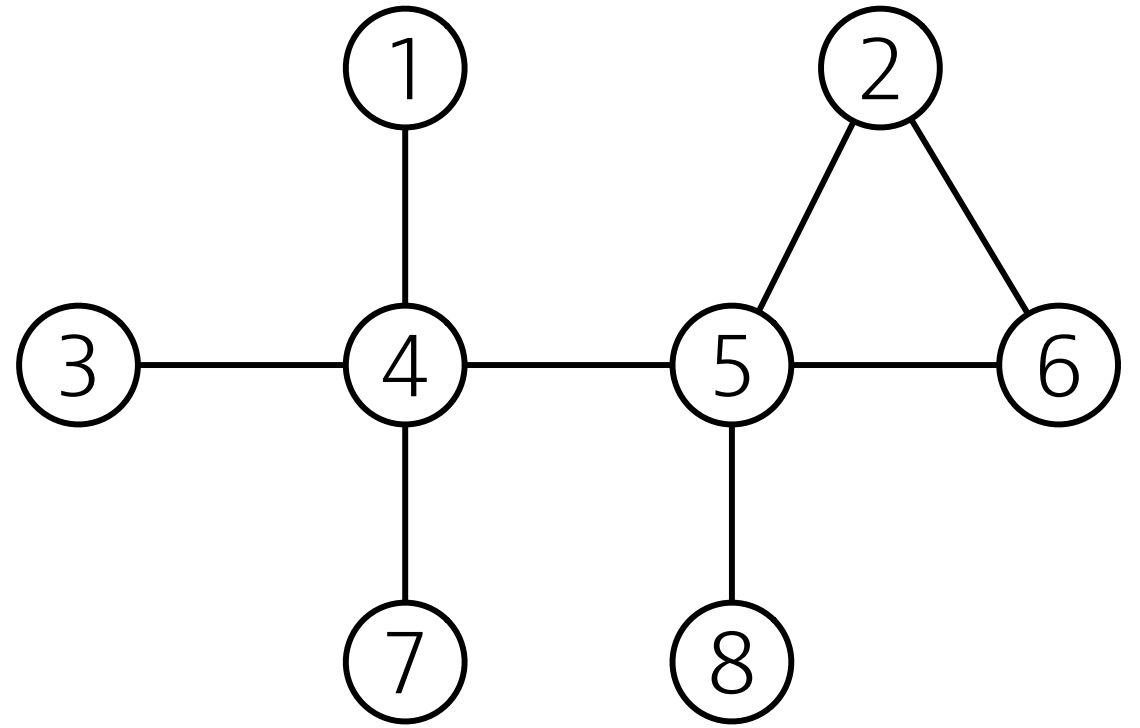




Maximum  
matching

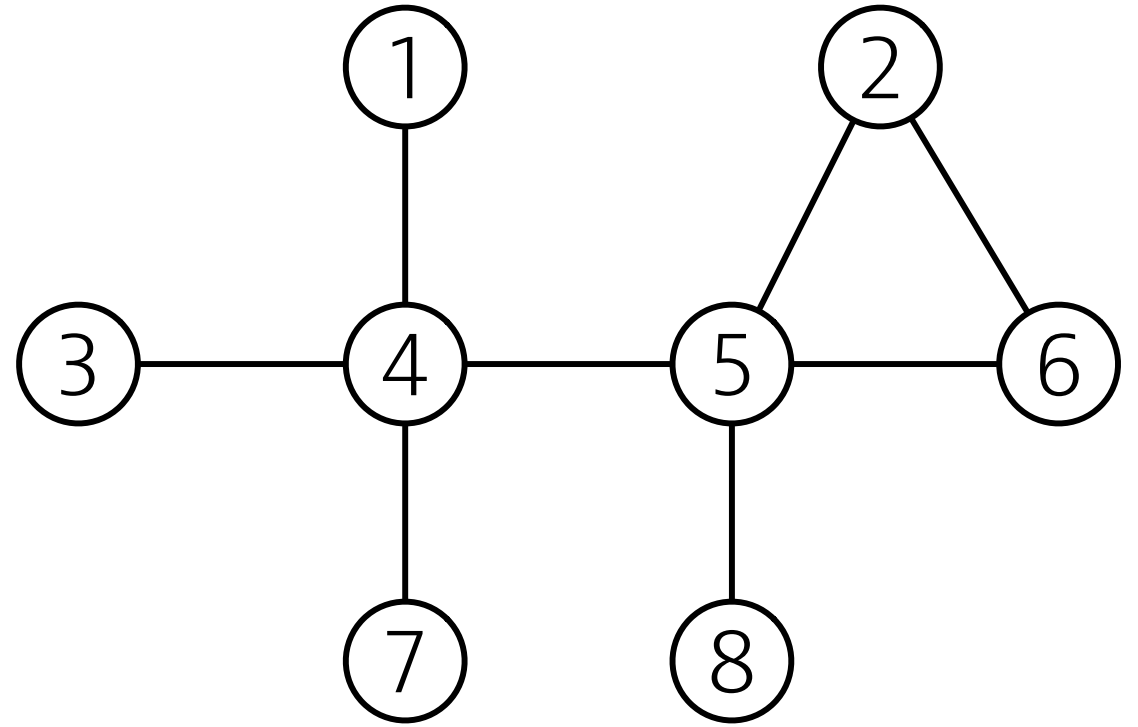


Minimum  
edge cover

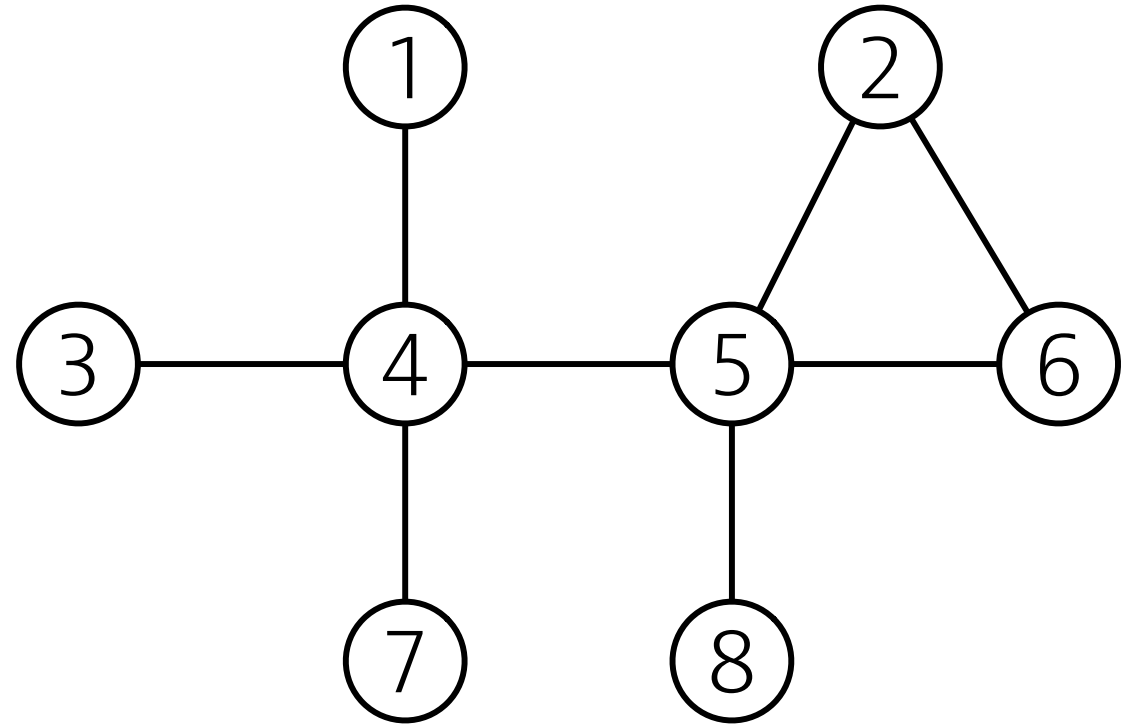


Minimum  
edge dominating set

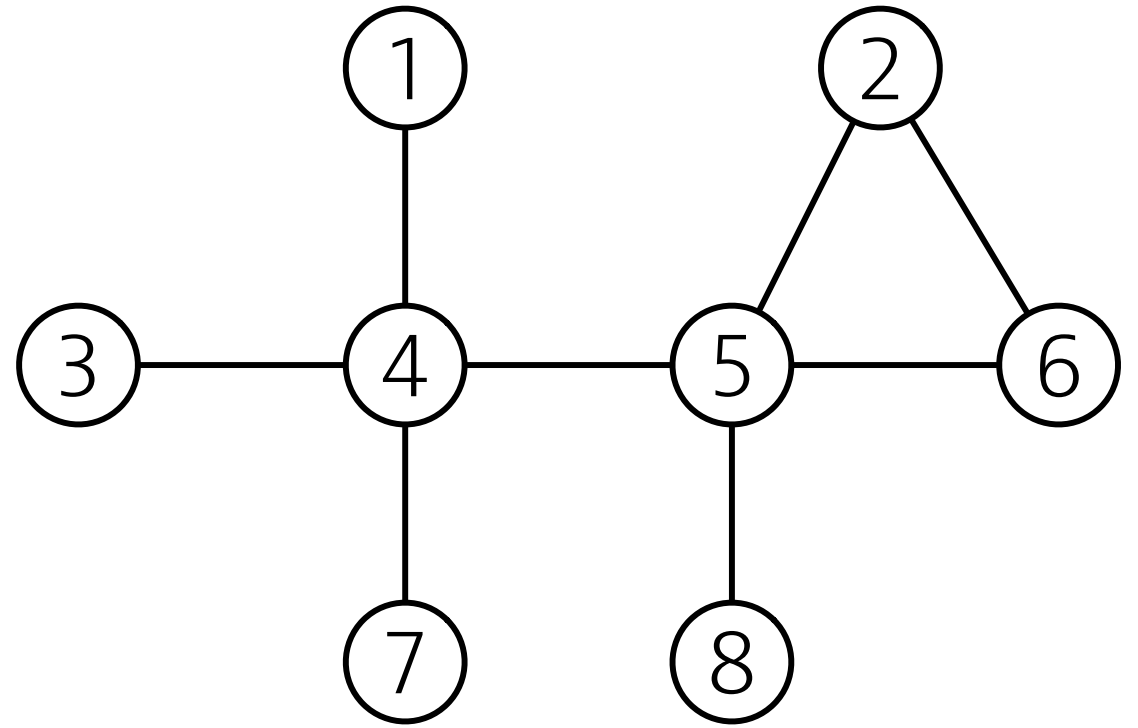
Smallest  
set of edges  
that is both  
a matching and  
an edge dominating set



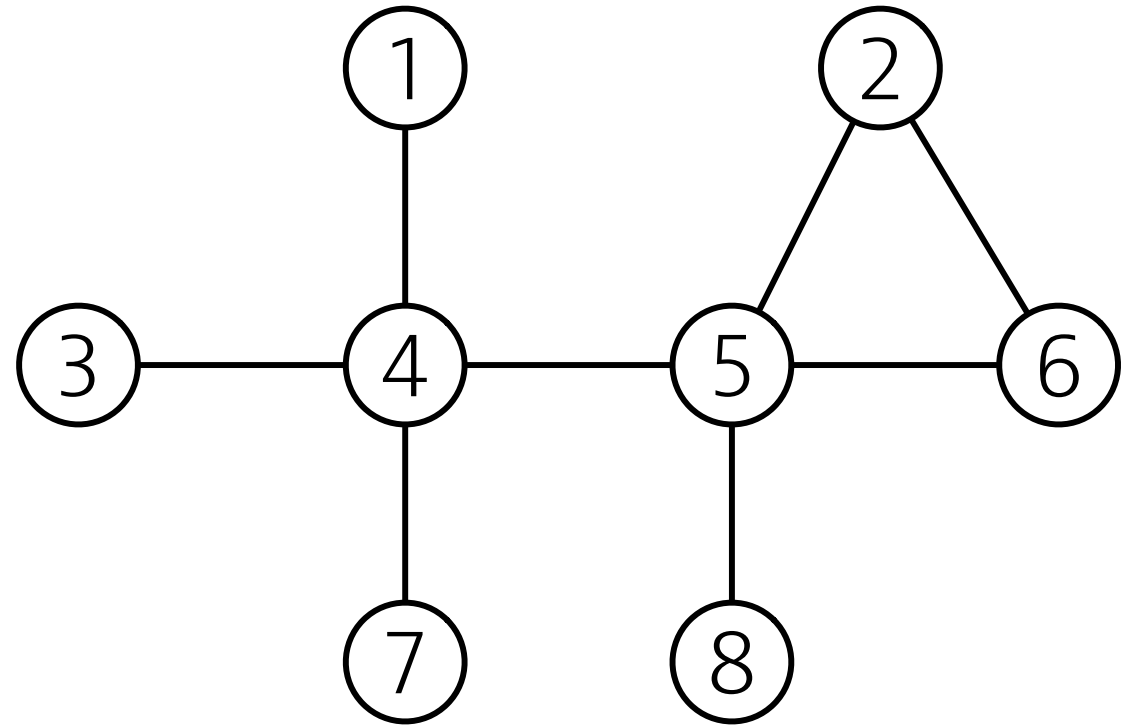
Largest  
set of edges  
that is both  
a matching and  
an edge dominating set





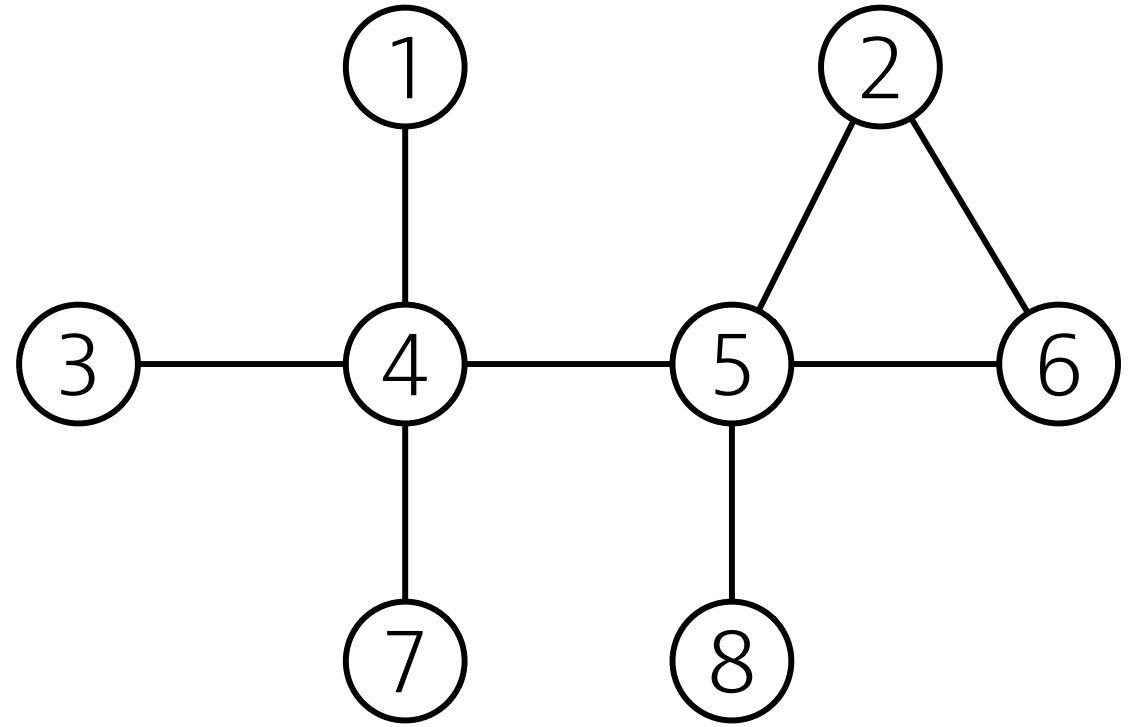


Minimum  
edge dominating set  
that is not a matching

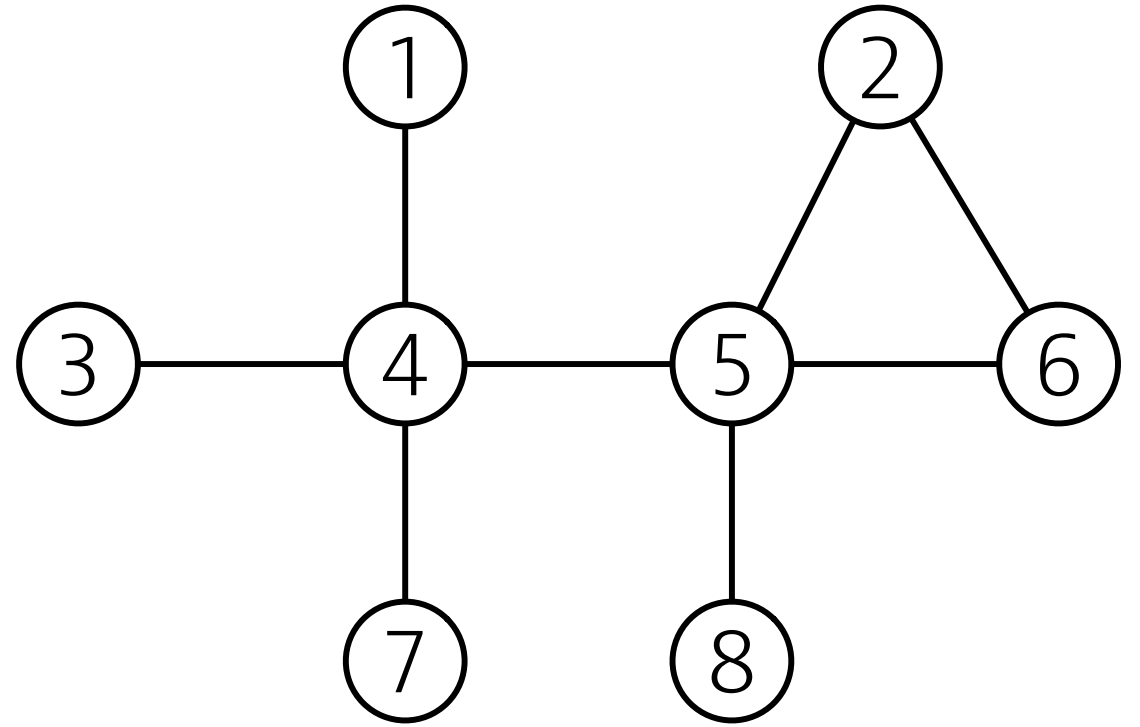


Largest set of  
nodes that induces  
a bipartite subgraph

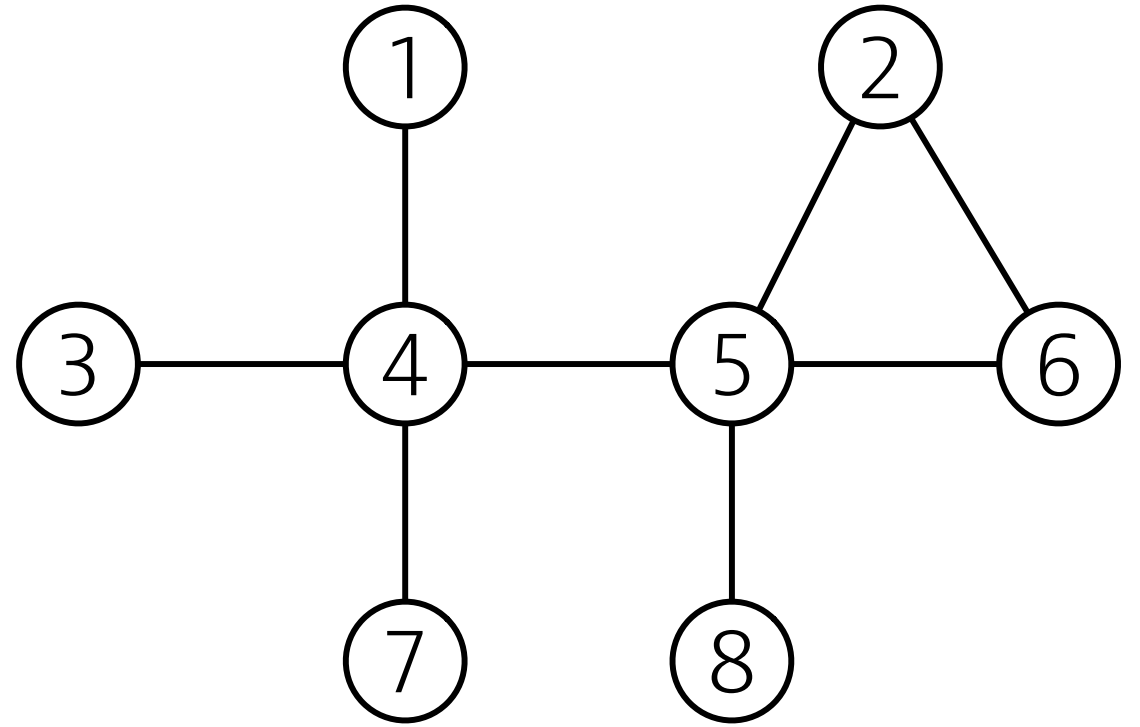
Largest  
set of edges  
that induces  
a subgraph with  
2 connected components

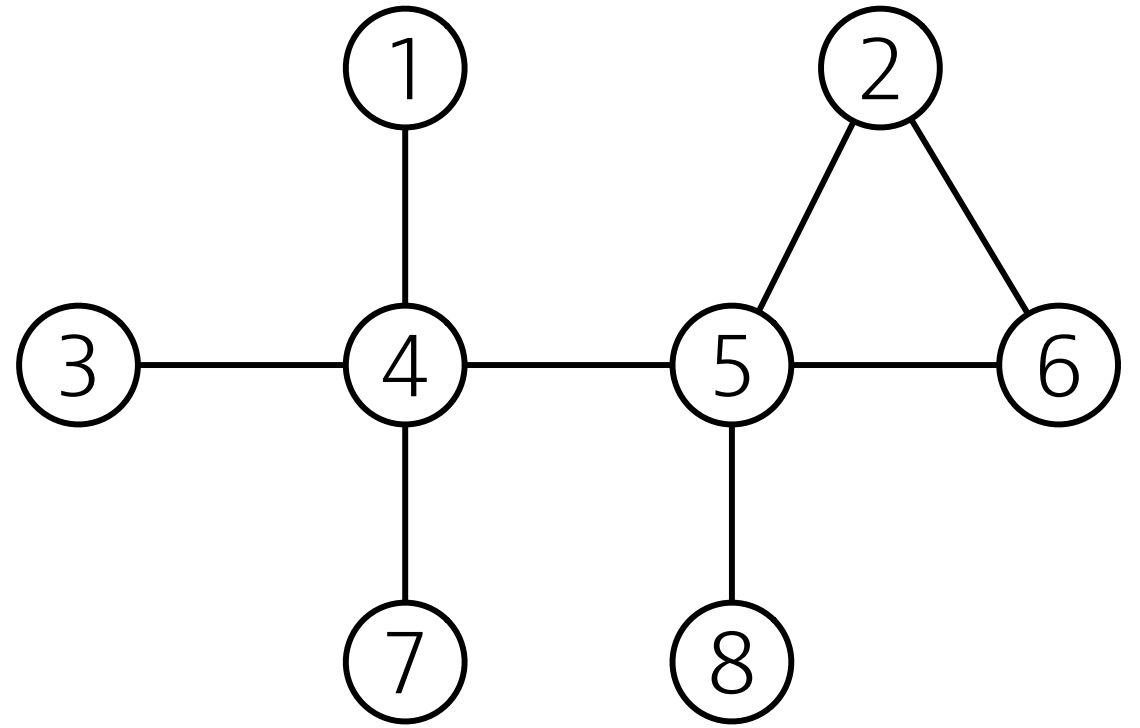


Largest  
set of nodes  
that induces  
a subgraph of  
maximum degree 2



Largest  
set of edges  
that induces  
a subgraph of  
maximum degree 2





Set of nodes  
that induces  
a 2-regular subgraph

Nodes  $u$   
and  $v$  such  
that the distance  
from  $u$  to  $v$  equals  
the diameter of the graph

