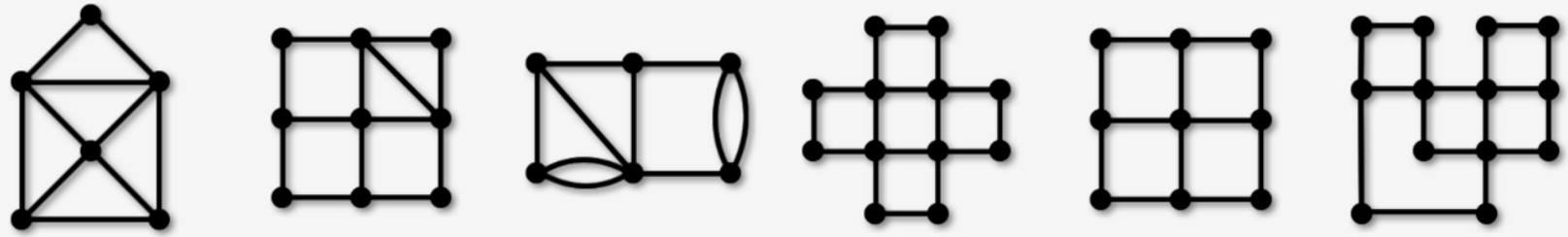
Exercise

Here are a couple of simple graphs. Determine which ones can be drawn without lifting the pencil and drawing a line twice. Now think about how many edges meet at every vertex and try to find a pattern.



Hamiltonian Path Problem

- Is it possible to visit every vertex of the graph exactly once?
- How long will it take us to compute whether Hamiltonian path exists in a given graph?

Travelling Salesperson Problem

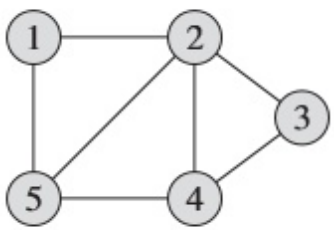
Visual Representation

- Nodes / vertices
- Edges
- Directed vs undirected graphs
- Weighted vs unweighted graphs
- Special vs general graphs

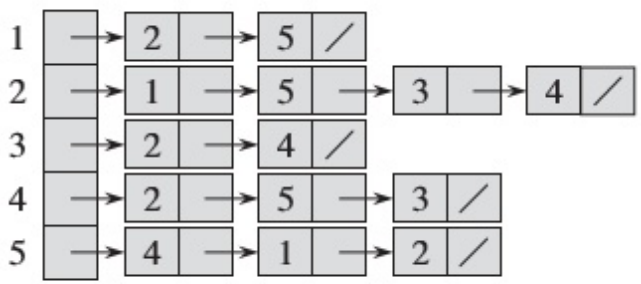
Some Fundamentals...

- Adjacent vertices
- Reachable vertices
- Path
- Cycle
- Set of vertices V
- Set of edges E
- $(u, v) \in E$, for $u, v \in V$
- Complexity representation as a function of V and E where V represents $|V|$ and E represents $|E|$
- Hamiltonian path / cycle
- Euler path / cycle

Representation as Data Structure



(a)

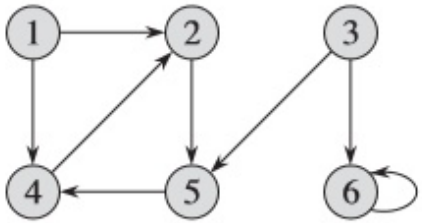


(b)

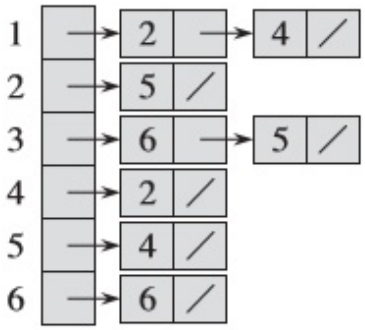
	1	2	3	4	5
1	0	1	0	0	1
2	1	0	1	1	1
3	0	1	0	1	0
4	0	1	1	0	1
5	1	1	0	1	0

(c)

Representation as Data Structure



(a)



(b)

	1	2	3	4	5	6
1	0	1	0	1	0	0
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	1	0	0	0	0
5	0	0	0	1	0	0
6	0	0	0	0	0	1

(c)

Representation as Data Structure

- Adjacency matrix
- Adjacency list
- Question-1: What would be the size of both of these concrete data structures in terms of V and E?
- Question-2: Which representation is better than the other?

Trees are a type of graphs

Assume that vertices are numbered from 1 to 7 in a binary heap.
Please draw it.
Give an equivalent adjacency-matrix representation.

Homework: Give an adjacency-list representation for a complete binary tree (heap) on 7 vertices.