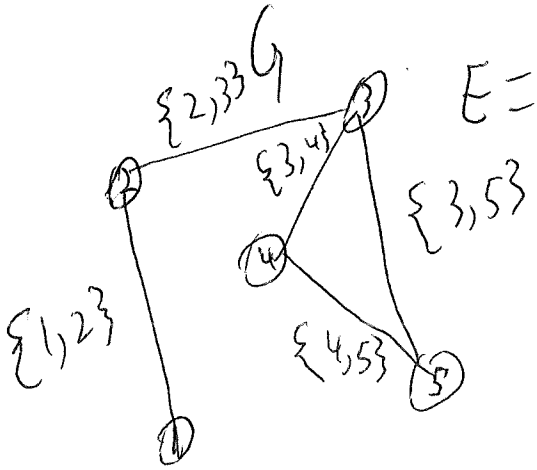
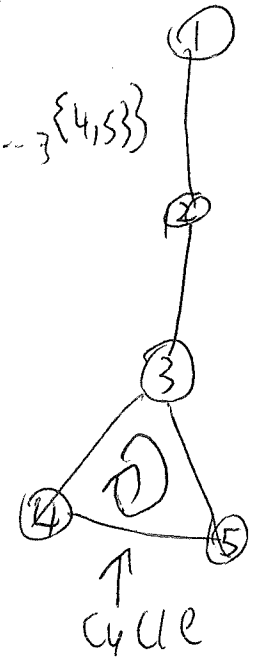
Lecture 2

Graphs

$V = \{1, 2, 3, 4, 5\}$

$E = \{\{1,2\}, \{2,3\}, \ldots, \{4,5\}\}$

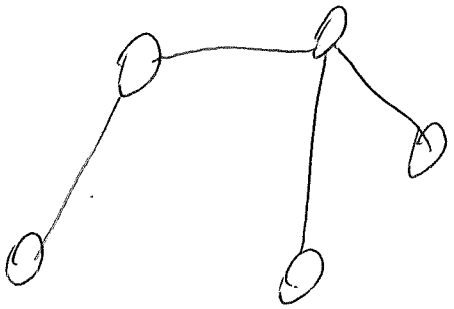




A Graph G contains a set of vertices (nodes) V and a set of Edges (arcs) E such that each edge $\{i, j\} \in E$ contains two (usually) distinct vertices.

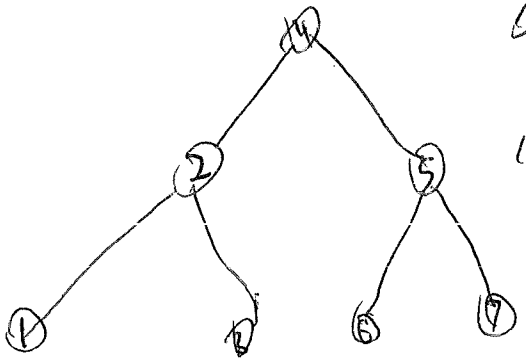
A Tree is a connected, acyclic Graph.

Ex 1.



G_1

Ex 2



0 th layer

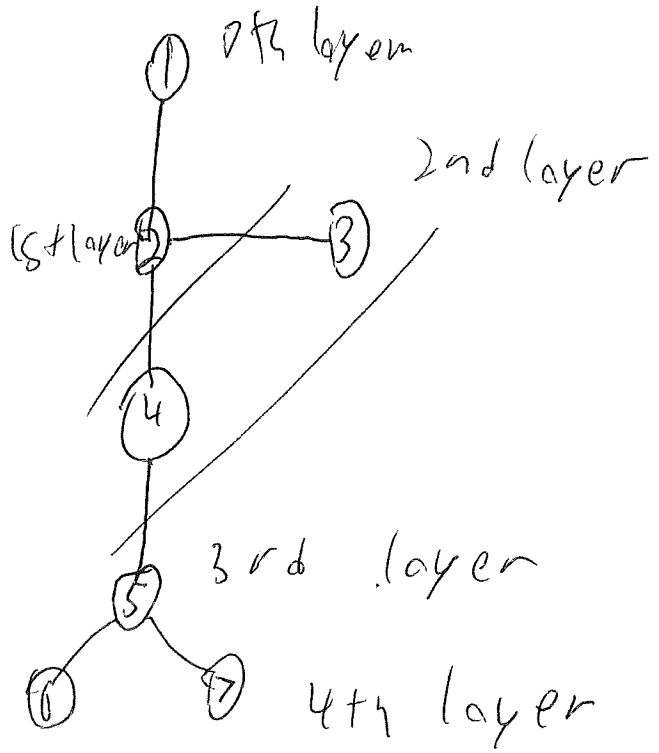
1st layer

G_2

2nd layer

Non Ex 3

G_3



A Rooted Tree is a tree with a special vertex called the root.

The number of edges a node is away from the root is the layer of the node.

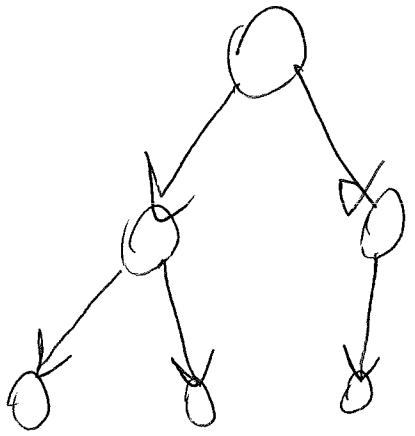
What can we store with graphs?

- Social interactions
- Biological networks
- Economic / political interactions
- Decision Trees
- Games
- ⋮

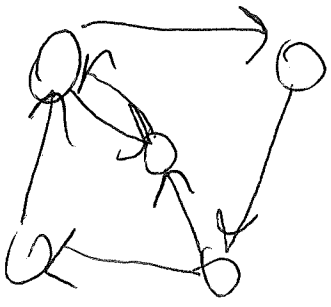
what addition structure can we add?

A directed graph (Digraph) is a graph with edges of the form (i, j). This edge leaves i and enters j.

Ex 1.

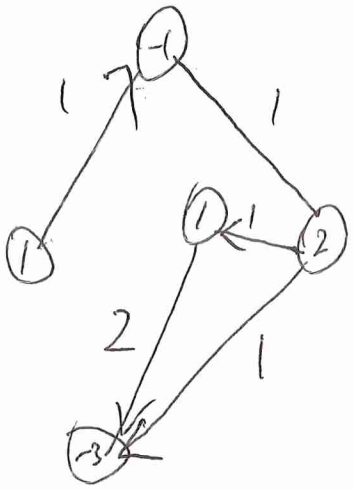


Ex 2.



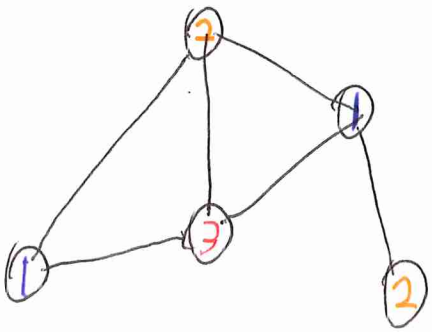
A weighted graph is a graph with numbers on each edge and/or node.

Ex.



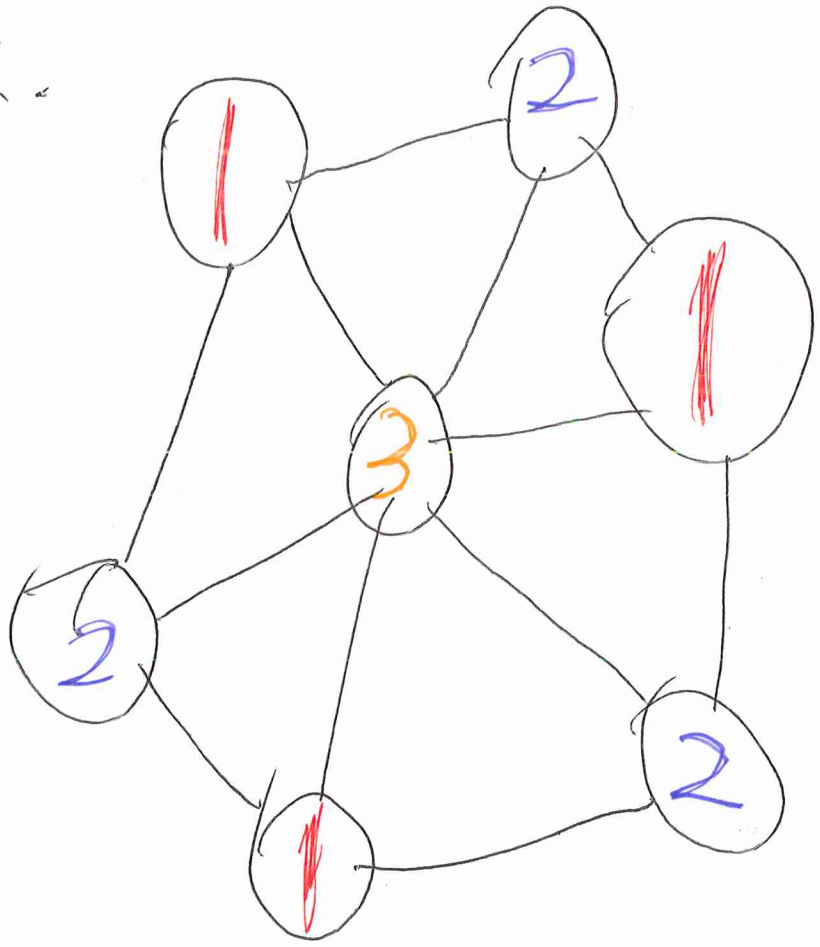
A graph is a colored graph if each vertex is assigned a color / label

Ex.



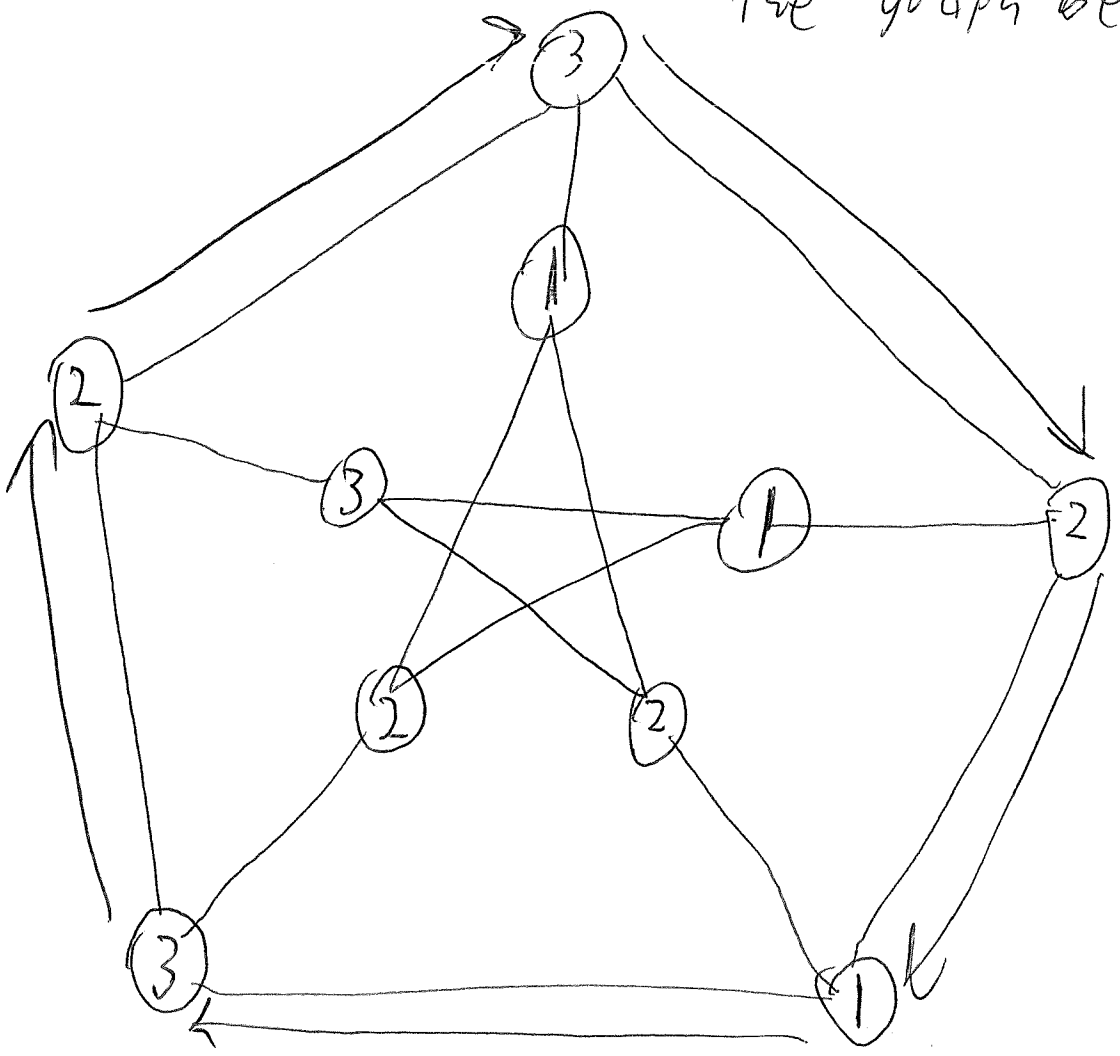
A Color of a graph has a proper coloring if no two adjacent vertices are the same color.

Ex.

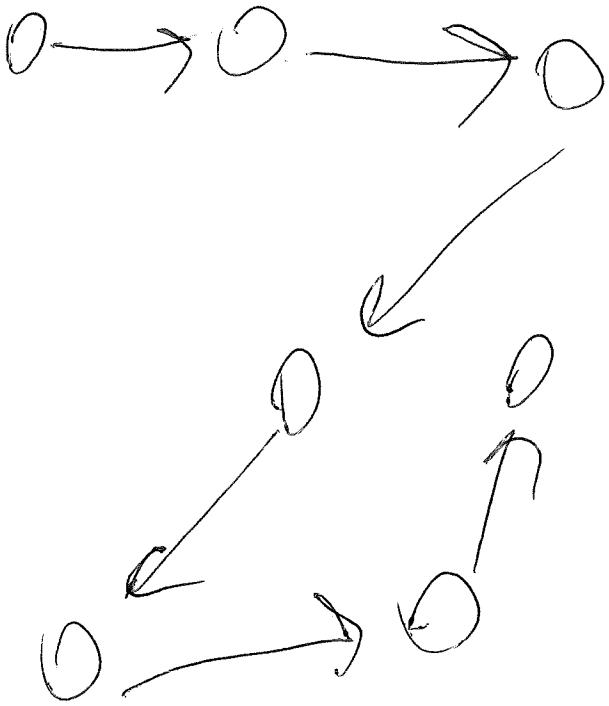


The chromatic number χ of a graph G is the minimal number of colors needed to admit a proper coloring.

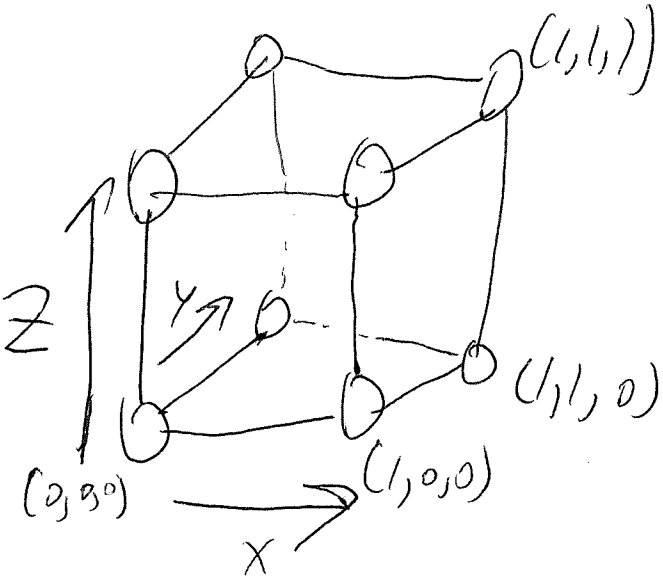
Exercise! Find χ for the graph below



Path Graph



Hyper Cube Graph



Stacks and Queues

A Stack is a data structure where the last element added is the first element removed.

(FILO) First in Last out.

A Queue is a data Structure where the first element added is the first element removed.

(FIFO) First in First out.