Lecture 28

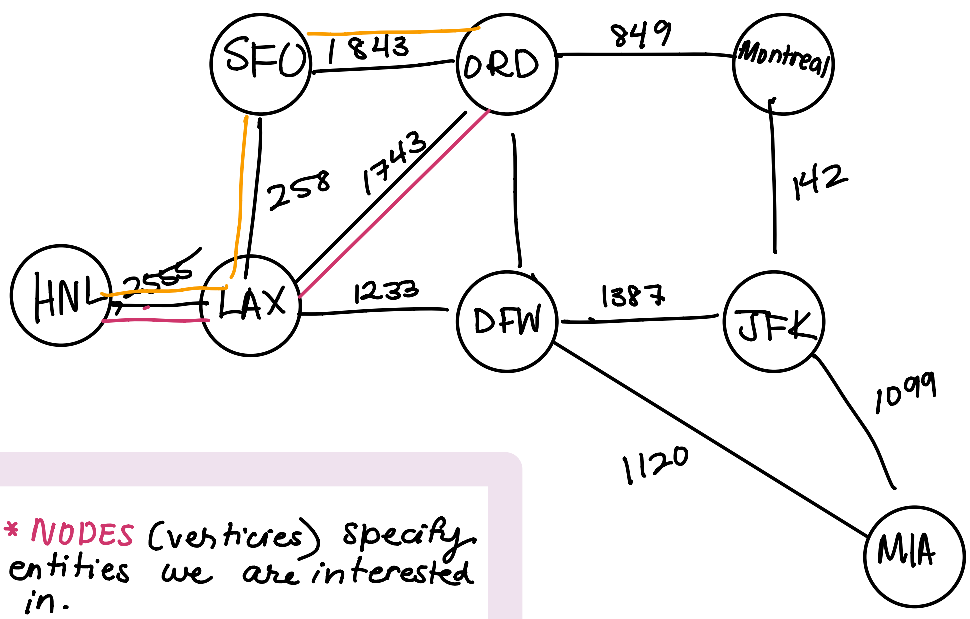
MOTIVATION - visualize flight routes in North America

- natural representation is a graph

① Create series of nodes (or vertices) w/ each node representing a city

- each node is airport code

② Connect any 2 cities (nodes) which have a flight route b/w them w/ a line (called an edge)



* NODES (vertices) specify entities we are interested in.

* EDGES - specify relationships b/w entities

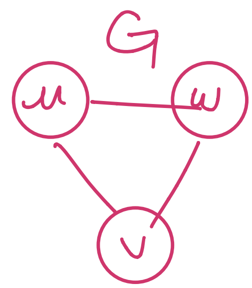
Def. A graph $G=(V,E)$ is a finite set of verticies V, and a finite set of edges, E, where each edge (u,v) connects 2 verticies, u and v

① Ex. we have

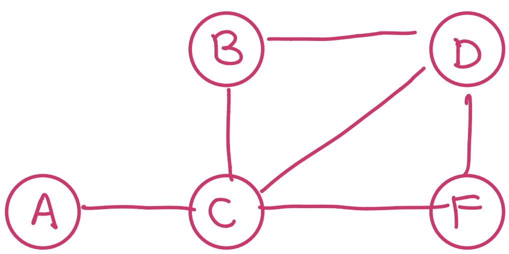
$G=(V,E)$

Verticies $V=\{u,v,w\}$

Edges $E=\{(u,v),(v,w),(w,u)\}$



②

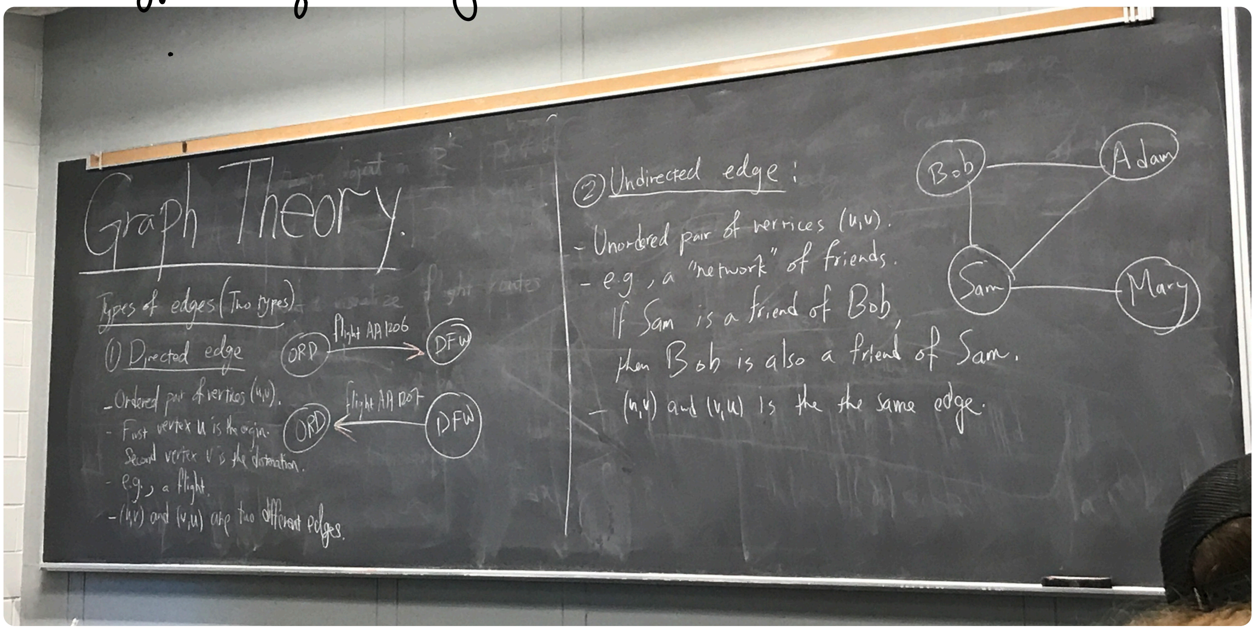


$G=(V,E)$

Verticies $V=\{a,b,c,d,e,f\}$

Edges $E=\{(a,c),(b,c),(b,d),$
$(c,d),(d,f),(c,f)\}$

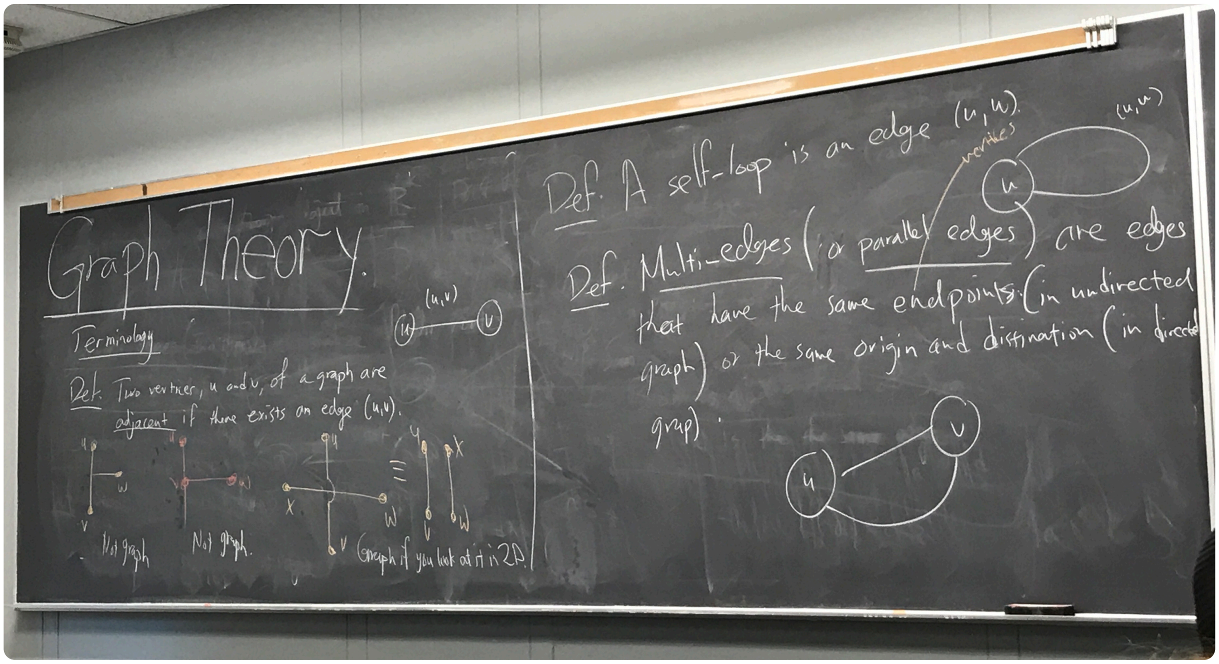
Types of Edges

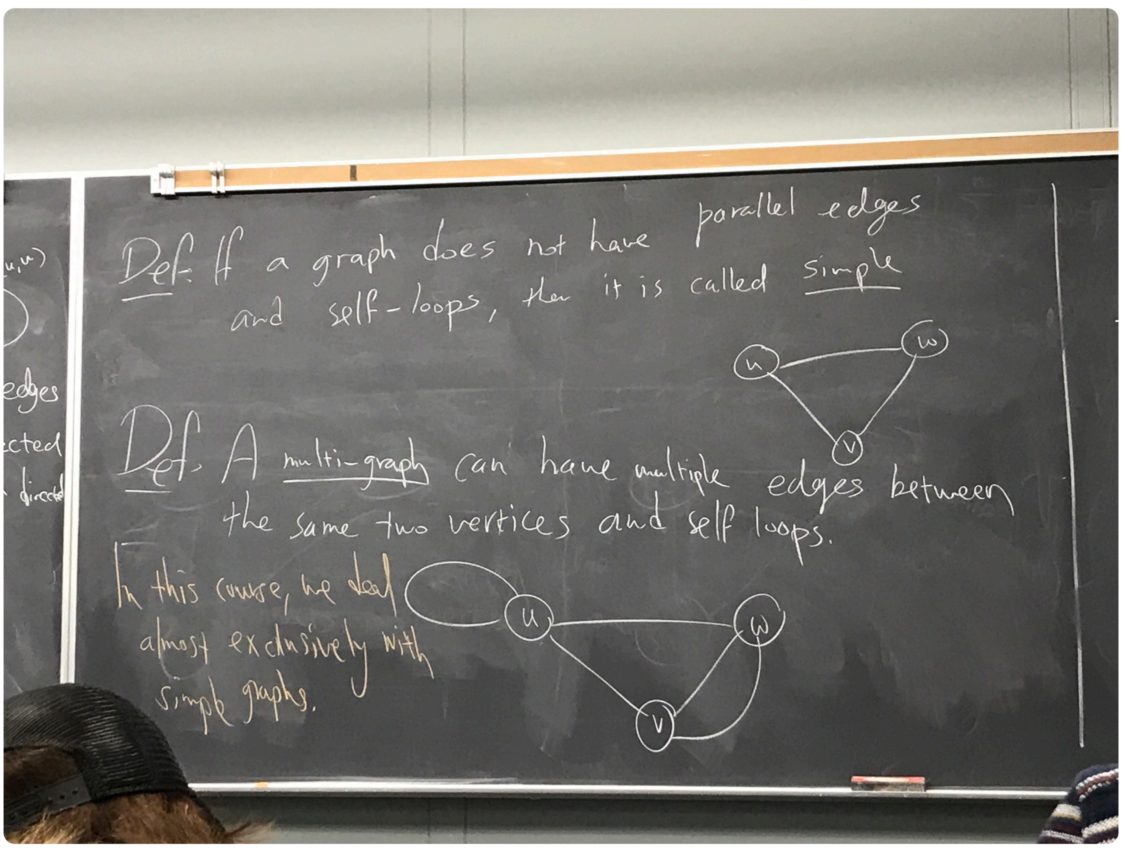


Types of Graphs

① Directed Graph
- all edges are directed
- route network

② Undirected Graph
- all edges are undirected
- friend network


Graph Theory.
Terminology
Def. Two vertices, u and v, of a graph are adjacent if there exists an edge (u,v).
(u,v)
u
v
w
x
Not graph
Not graph.
Graph if you look at it in 2D.
Def. A self-loop is an edge (u,u).
vertices
(u,u)
Def. Multi-edges (or parallel edges) are edges that have the same endpoints (in undirected graph) or the same origin and destination (in directed grap).


Def. If a graph does not have parallel edges and self-loops, then it is called simple
u
w
v
Def. A multi-graph can have multiple edges between the same two vertices and self loops.
In this course, we deal almost exclusively with simple graphs.