2/27/2018

1. Graphs
2. DFS
3. BFS (Code both 2 ways)
4. Top Sort Idea (if time)

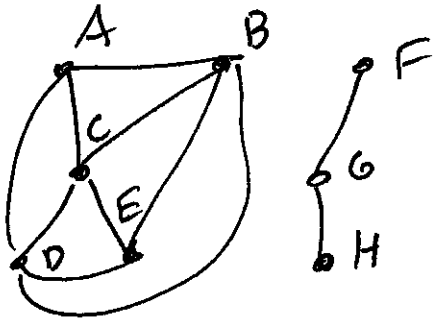
Graph

Collection vertices and edges where an edge is a pair of vertices that are connected.

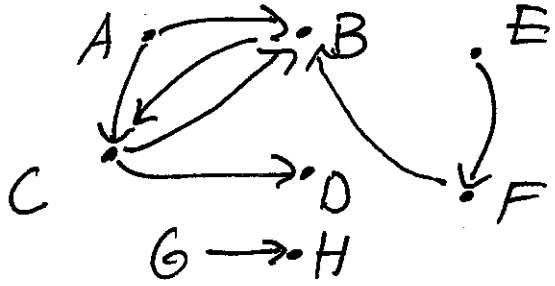
- unweighted vs weighted → each edge has an associated number called its weight
- undirected vs directed
  - undirected: no order to the pair of vertices
  - directed: ordered pair of vertices

Intuitively, vertices are dots.
edges connect the dots.

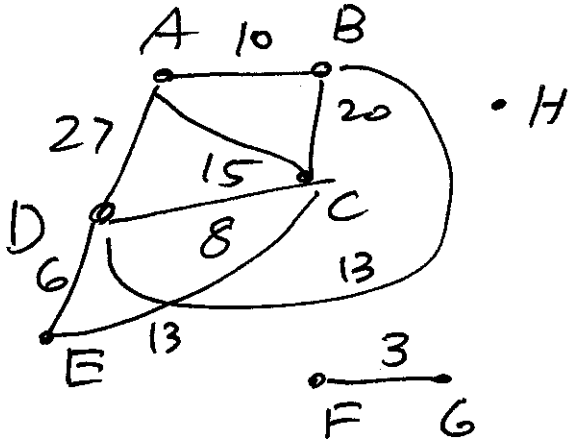
Undirected, Unweighted



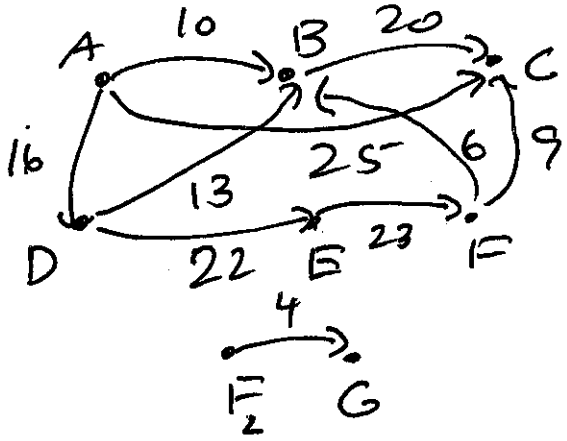
Directed, Unweighted



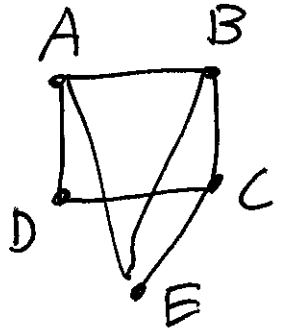
UnDirected, Weighted



Directed, Weighted



1. How to Store
3. ~~2~~ How to Code
2. ~~3~~ How to Search/Catalog each vertex.



From

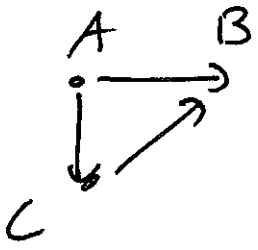
Adj. Matrix To 2D Array

	A	B	C	D	E
A	0	1	0	1	1
B	1	0	1	0	1
C	0	1	0	1	1
D	1	0	1	0	0
E	1	1	1	0	0

Edge List

Array of Lists

A → B, D, E
B → A, C, E
C → B, D, E
D → A, C
E → A, B, C

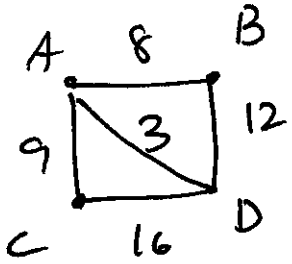


	A	B	C
A	0	1	1
B	0	0	0
C	0	1	0

Unweighted Directed

A → B, C
B → X (null)
C → B

Edge List

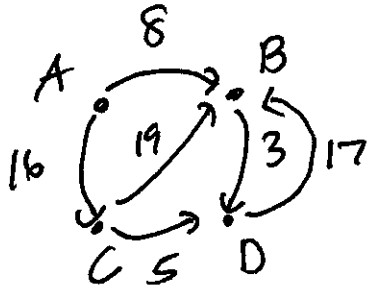


	A	B	C	D
A	0	8	9	3
B	8	0	∞	12
C	9	∞	0	16
D	3	12	16	0

Adj Mat

A → (B,8) → (C,9) → (D,3)
B → (A,8) → (D,12)
C → (A,9) → (D,16)
D → (A,3) → (B,12) → (C,16)

Edge List



	A	B	C	D
A	0	8	16	∞
B	∞	0	∞	3
C	∞	19	0	5
D	∞	17	∞	0

A → (B,8), (C,16)
B → (D,3)
C → (B,19) → (D,5)
D → (B,17)

CS1 Stuff

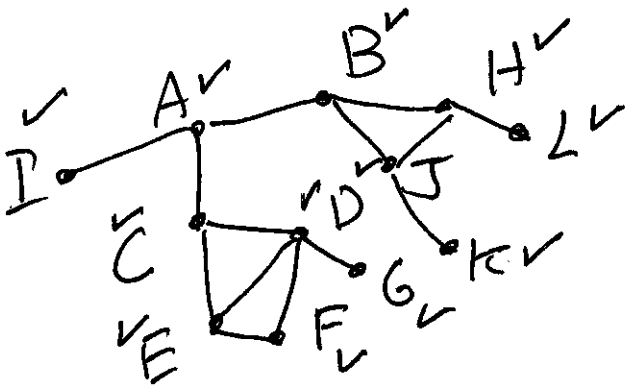
Linked Lists
Trees
} Traversals

Goal: Visite each item in the structure.

Undirected, Unweighted Graph Traversals

(1) Depth First Search
(2) Breadth First Search

```
DFS(G, v, used) {
    used[v] = true;
    for each neighbor u of v:
        if (!used[u])
            DFS(G, u, used)
}
```



~~DFS(K)~~
~~DFS(J)~~ ~~DFS(L)~~ ~~DFS(P)~~
~~DFS(H)~~ ~~DFS(B)~~ ~~DFS(D)~~ ~~DFS(G)~~
~~DFS(B)~~ ~~DFS(C)~~ ~~DFS(E)~~
~~DFS(A)~~

A, B, H, J, K, L, C, D, E, F, G, I

BREADTH FIRST SEARCH

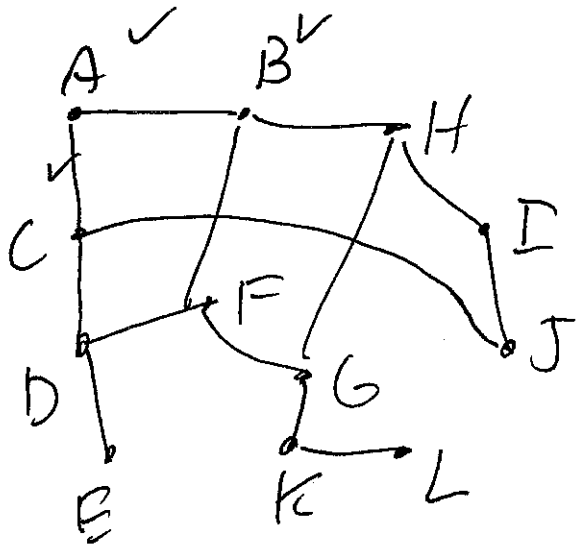
```
BFS(G, v, used) {
    queue q;
    q.add(v)          dist[v] = 0
    used[v] = true;
    while (q.size() > 0) {
        Vertex cur = q.poll();
        for each neighbor next of cur {
            if (!used[next]) {
                q.offer(next);
                used[next] = true;
                dist[next] = dist[cur] + 1;
            }
        }
    }
}
```

OBFS①	OBFS②	OBFS③	B3-1	B4-0	B4-1
Nathan	Camilo	Ian	John	Daniel	Justin

B5-0	B5-1	B3-2	B3-2	B3-1
Suraj	Steve	Lewis	Shane	Melanie

Q: ~~Ian~~, ~~John~~, ~~Melanie~~, ~~Lewis~~, ~~Shane~~

Q: ~~Daniel~~, ~~Justin~~



BFS(A)

Q:	A	B	C	F	H	D	J
	0	1	1	2	2	2	2
	G	I	E	K	L		
	3	3	3	4	5		