

CS2 101 1-12-21

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• Quiz 1 today 6PM - 2am
will have 45 min.

• Pa1 ext. Fri Jan 15

• Pa2 Posted

Quiz 1 Preparation :

write a client-function that
returns a new List that is
the reversal of its argument
List.

```

List reverse (List L) {
    List R = newList();
    int x;
    for (moveFront(L); index(L) >= 0;
        moveNext(L)) {
        x = get(L);
        prepend(R, x);
    }
    return R;
}

```

Ex

L : 1 2 3

R : 3 2 1 → return

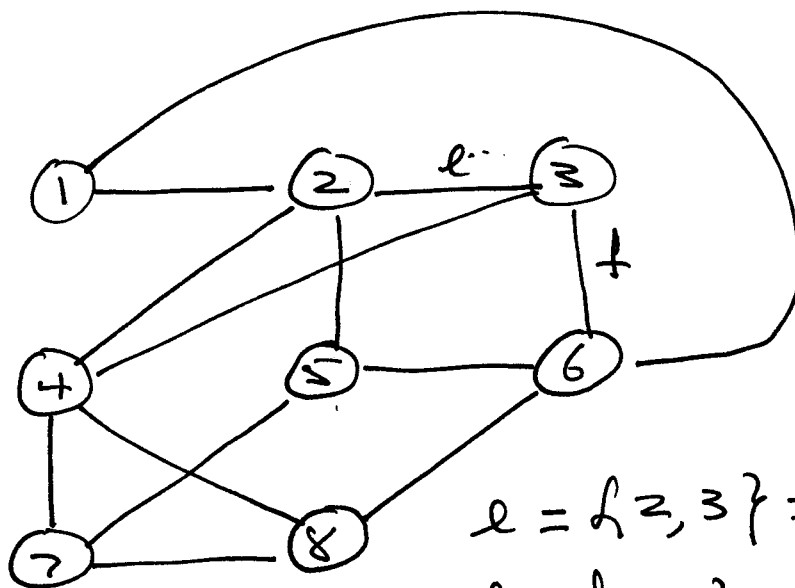
Graphs

what is a graph?

Ex.

$$\deg(1) = 2$$

$$\deg(4) = 4$$



$$\deg(3) = 3$$

$$e = \{2, 3\} = 23$$

$$f = \{3, 6\} = 36$$

$$G = (V, E)$$

$$V = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$E = \{12, 16, 23, 24, 25, 34, 36, 47, 48, 56, 57, 68, 78\}$$

we say: 2 is adjacent to 3
2, 3 are the ends of e
2, 3 are incident with e
 e is adjacent to f

The degree of a vertex is the # of edges incident with it.

Defn

• an x - y walk is a sequence
 $x = v_0, v_1, v_2, \dots, v_k = y$ of $\left\{ \begin{array}{l} \text{called } \underline{\text{closed}} \\ \text{iff } x = y \end{array} \right.$

where each consec. pair of vertices are adjacent, i.e.

$$\{v_{i-1}, v_i\} \in E \text{ for } i=1, \dots, k$$

Ex 1-7 walk:

1, 2, 5, 2, 3, 6, 8, 4, 7

length = # of edge traversals.

$$= 8$$

Ex. 3, 6, 8, 6, 3 closed walk
 of length 4.

Ex. trivial walk : length 0.

5

Defn

- an $x-y$ trail is a walk in which no edge is traversed more than once.

Ex. 2, 4, 7, 5, 2, 3 length = 5

Defn

- an $x-y$ Path is a trail in which no vertex is visited more than ~~one~~ once

Ex. 1, 2, 5, 7, 8 length = 4

1, 6, 3, 2, 5, 7, 8 length = 6

1, 6, 8 length = 2 Shortest

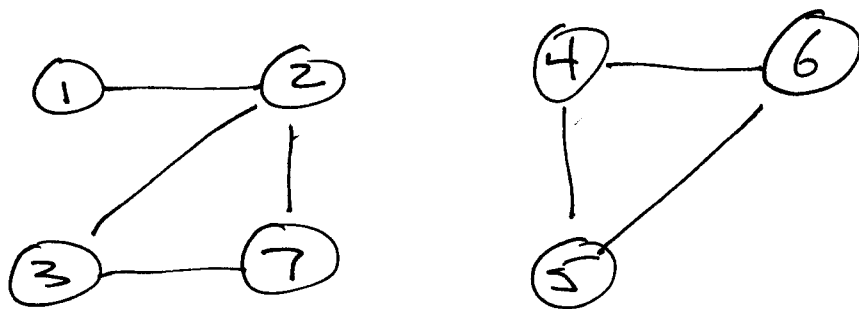
Problem { Single Source Shortest Path } 6

Given a graph $G = (V, E)$, and source vertex $s \in V$.

(1) find distance (shortest Path length) from s to every other vertex in G .

(2) find a shortest $s-x$ Path for all $x \in V$ reachable from s .

Ex. disconnected graph



no 4-7
Path
no 1-5
Path

$$V = \{1, 2, 3, 4, 5, 6, 7\}$$

$$E = \{12, 23, 27, 37, 46, 45, 56\}$$

Defn

we say y is reachable from x if G contains an $x-y$ path.

Defn

G is called connected iff for all $x, y \in V$: x is reachable from y and y from x . If G is not connected it is called disconnected.

Defn (distance fcn.)

$$d(x, y) = \begin{cases} \text{length of a min. length} \\ \text{x-y path if y is reachable} \\ \text{from x.} \\ \infty \text{ otherwise} \end{cases}$$

How do we represent graphs
in a program?

Adjacency List representation

an array of lists

adj

1 : 2, 6
2 : 1, 3, 5
3 : 2, 4, 6
4 : 2, 3, 7, 8
5 : 2, 6, 7
6 : 1, 3, 5, 8
7 : 4, 5, 8
8 : 4, 6, 7

← Previous example

$adj[4] = (2, 3, 7, 8)$