CMSC 341
Lecture 22

Announcements

Adjacency List

Keep list of adjacent vertices for each vertex.

- **Array of lists of indices**: Each element of array[i] is a list of the indices of the vertices adjacent to vertex i.
- **List of lists**: The i-th element of L is associated with vertex v_i and is a List L_i of the elements of L adjacent to v_i.
- **Lists in Array** (NIL sentinels): Each entry a[i,j] is either the index of the j-th vertex adjacent to vertex I or a NIL sentinel indicating end-of-list.
- **Lists in Array** (with valence array): Instead of using NIL sentinels to mark theend of the list in the array, a separate array Valence is kept indicating the number of entries in each row of the array.

Adjacency Lists (cont.)

Storage requirement:

Performance:

	Array of Lists	List of Lists	Lists in Array (NIL)	Lists in Array (val)
getDegree				
getInDegree				
getOutDegree				
getAdjacent				
getAdjacentFrom				
isConnected				

Directed Acyclic Graphs

A *directed acyclic graph* is a directed graph with no cycles.

A *partial order* R on a set S is a binary relation such that

- for all a∈ S, aRa is false (irreflexive property)
- for all a,b,c ∈ S, if aRb and bRc then aRc is true (transitive property)

To represent a partial order with a DAG:

- represent each member of S as a vertex
- for each pair of vertices (a,b), insert an edge from a to b if and only if aRb.

More Definitions

Vertex i is a predecessor of vertex j if and only if there is a path from i to j.

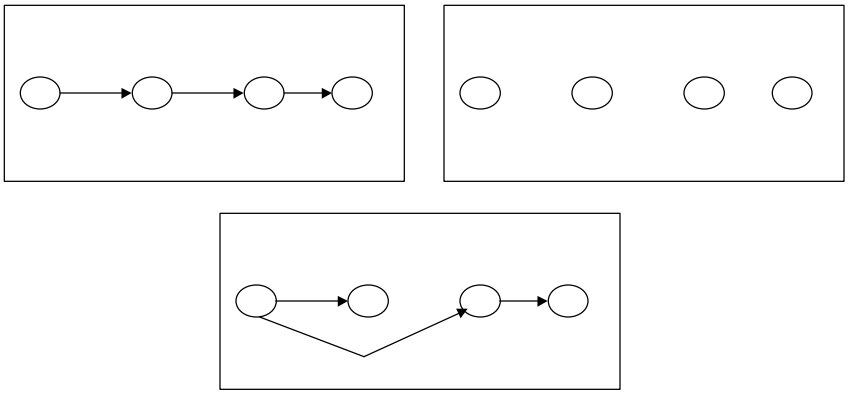
Vertex i is an immediate predecessor if vertex j if and only if (i,j) is an edge in the graph.

Vertex j is a successor of vertex i if and only if there is a path from i to j.

Vertex j is an immediate predecessor if vertex i if and only if (i,j) is an edge in the graph.

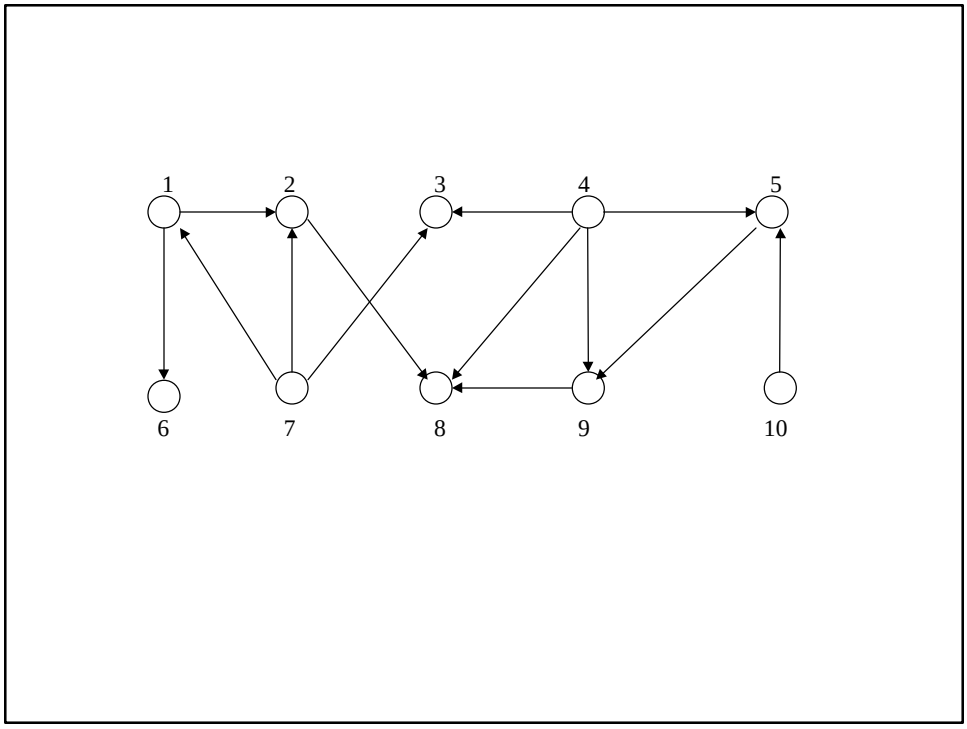
Topological Ordering

A topological ordering of the vertices of a DAG G=(V,E) is a linear ordering such that, for vertices i,j ∈ V, if i is a predecessor of j, then i precedes j in the linear order.



Topological Sort

```
void TopSort(Graph G) {
   unsigned int counter = 1 ;
   Queue q = new Queue();
   Vertex indegree[|V|];
   for each Vertex v {
        indegree[v] = getInDegree(v);
        if (indegree[v] == 0) q.enqueue(v); }
   while (!q.isEmpty()){
        v = q.dequeue();
        Put v on the topological ordering;
        counter++;
        for each Vertex v adjacent from v {
               indegree[w] -=1;
               if (indegree[w]==0) q.enqueue(w);
               }
        }
   if (counter <= G.numVertices())
        declare an error -- G has a cycle
   }
```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