EE360C: Algorithms

Graphs
(Incidence Matrix)

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In Class Exercise

An *incidence matrix* can also be used to represent a graph. An incidence matrix *M* has a row for each vertex and a column for each edge. $M[i, j] = 1$ if vertex *i* is part of the edge *j*.

- Give an efficient algorithm to convert an adjacency list representation to an incidence matrix. What is the time complexity of your algorithm?
- Give an efficient algorithm to convert an incidence matrix to an adjacency list representation. What is the time complexity of your algorithm?

Assume lookup functions that map a given vertex to an index *i* and a given edge to an index *j*.

Convert adjacency list to an incidence matrix:

1   create M of size $|V| \times |E|$
2   **for** every $v \in G.V$
3   **do** lookup i for v
4   **for** every $u \in Adj[v]$
5   **do** lookup j for (u, v)
6   set $M[i, j] = 1$

Running time: $O(|V| + |E|)$

In Class Exercise

Convert an incidence matrix to an adjacency list:

1 **for** each $v \in G.V$
2   **do** create empty list $Adj[v]$
3   lookup i for v
4   **for** $0 \leq k \leq |E|$
5   **do if** $M[i, k] = 1$
6   **then** lookup (v, u) for k
7              $Adj[v] = Adj[v] \cup (u)$

Running time: $O(|V||E|)$

Questions