Condensed Representation of Incidence Matrix for Directed Graph with Self-Loops

Yash Sharma - IHM2014006
Aditya Kumawat - ICM2014001

Overview

Proposed Representations of Incidence Matrix

- Base Representation
- Base Representation with Destinations
- Bit Encoding
- Vector<Pair> Representation

Base Representation

- N - no. of vertices
  E - no. of edges
- Matrix ’A’ of size N x E
- Initialize all values with 0s.

- For every edge ’e’ starting from vertex ’v1’ to ’v2’,
  - A[v1][e] = 1
  - A[v2][e] = 2.
- For self-loops at vertex ’v’,
  - A[v][e] = 3

Base Representation with Destination

- N - no. of vertices
  E - no. of edges
- Matrix ’A’ of size N x E
- Initialize all values with -1s
- For every edge ’e’ from vertex ’v1’ to ’v2’,
  - A[v1][e] = v2.
- For self-loops at vertex ’v’,
  - A[v][e] = v.

Bit Encoding

- N - no. of vertices
  E - no. of edges
- Array ‘B’ of size N
- Initialize all values with 0s.
- Calculate Quaternary numbers for every vertex ’v’ by appending values of every column in A[v] row.
- For every vertex ’v’,
  - B[v] = conversion of Quaternary number to Decimal number.

Vector Pair Representation

- Define a new Data Structure as a vector of pairs of integers
    - Vector<Pair<int, int>>
- For every edge ’e’ between ’v1’ and ’v2’,
    - If A[v][e] = 1
      Then v1 = v;
    - If A[v][e] = 2
      Then v2 = v;
    - If A[v][e] = 3
      Then v1 = v & v2 = v;
- Push Pair (v1, v2) to Vector

Results

For N and E,

- If N>>E, vector<pair> representation is better.
- If N<=E, base representation is better.