12-12-2024

Ways of representation:

(i) Dependency Matrix:

a modified version of adjacency matrix that is defined as follows:

~~Provided $G(V,E)$~~

Given an agent behavior dependency graph (ABDG) $G(V,E)$ with n vertices (i.e., $|V| = n$), dependency matrix, D is an $n \times n$ matrix representing the nature of edges between the pairs of vertices as:

with $1 \le i \le n$
& $1 \le j \le n$, $v_i, v_j \in V$

$$D_{ij} = \begin{cases} 0, & \text{if no direct edge exists between } v_i \& v_j \\ 1, & \text{if } v_i \to v_j \text{ is a control dependency} \\ 2, & \text{if } v_i \to v_j \text{ is an inter-agent message dependency} \\ 3, & \text{if } v_i \to v_j \text{ is a procedure call dependency} \\ 4, & \text{if } v_i \to v_j \text{ is a return dependency} \\ 5, & \text{if } v_i \to v_j \text{ is an inter-agent data dependency} \\ 6, & \text{if } v_i \to v_j \text{ is a data dependency} \end{cases}$$

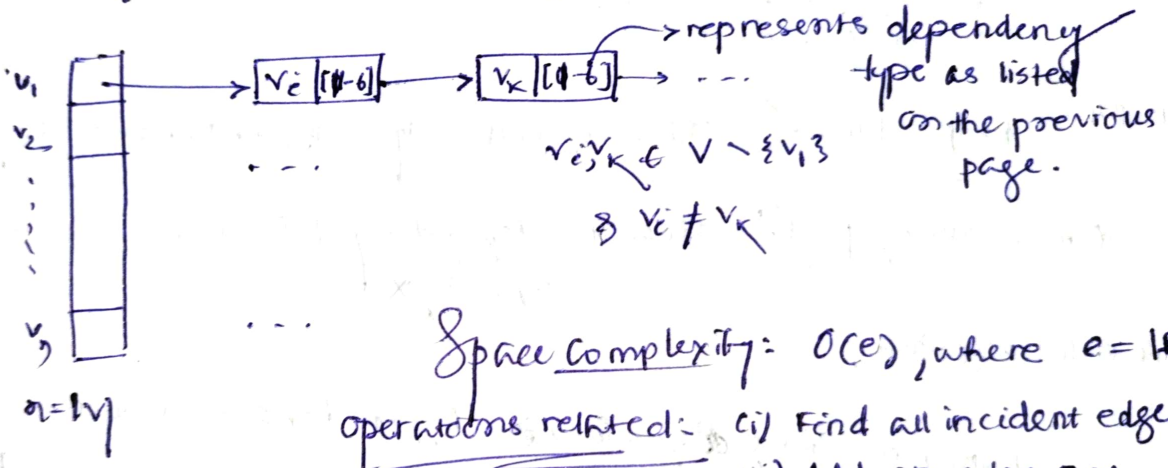
Space complexity: $O(n^2)$

→ Related operations & their time complexities:

(i) find all incident edges: $\theta(n)$
(ii) find the nature of an edge given the endpoints: $O(1)$
(iii) Addition of an edge: $O(1)$ (or removal)
(iv) Addition of a vertex: $O(n)$ (or removal)
(v) Traversal: $O(n^2)$

(iii) Dependency-list: (kind of incidence list).

↳ At each vertex, list of all incident edges & their nature is stored as:



Space complexity: $O(e)$, where $e = |E|$

operations related:
(i) Find all incident edges: $O(e)$
(ii) Add an edge: $O(e)$
(iii) Add a vertex: $O(1)$
(iv) Find the nature of an edge given the endpoints: $O(e)$
(v) Traversal: $O(ne)$