

CSE 674 Advanced Data Structures

Example: Topological Sort

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Motivations

The *Topological Sort* Example

- ▶ Use both Sequential and Linked Allocation
- ▶ Use more than one node structures
- ▶ Can be analyzed relatively easily

What is Topological Sort?

- ▶ Data are *partially ordered*
 - ▶ The set of procedures performed in a manufacturing process (PERT, CRT)
 - ▶ Implementation of programming languages
- ▶ Mathematical definition
 - ▶ Reflexive
 - ▶ Anti-symmetric
 - ▶ Transitive

Terms and Notations

- ▶ S (the collection of items, partially ordered)
- ▶ For any two distinct items of S , say a and b , we have either one of the following cases:
 1. a precedes b (expressed as $a < b$)
 2. b precedes a (expressed as $b < a$)
 3. neither $a < b$ nor $b < a$

Other concepts: immediate predecessors and immediate successors

A Simple Method

1. Remove an item i from S which is not preceded by any other items.
2. Remove i .
3. Re-apply the method to the remaining elements (i.e. $S - \{i\}$)

Question: Does it sound like sorting ? Name a sorting method that use similar ideas.

Example

Course Pre-requisite structure in a College

Course	Prerequisites
612	400, 411
818	412, 612
411	311
412	113, 311, 420
420	113

Question: How will you use sequential/linked allocation ?

Data Structures I

Phase 1: Building a data structures to store the relations.
Suppose we have the following table:

1	2	3	4	5	6	7	8
400	612	818	412	411	420	311	113

Data Structures II

Phase 2: Compute a topologically sorted sequence

Question How to make use of a data structure to compute a topologically sort sequence ?

The Algorithm (Discussions)

Suppose we have n items and m predecessor-successor relations

1. Build data structures to store the predecessor information.
Needs $O(m + n)$ time
2. At this point:

Discussions

- 2.1 How to compute a topological sorted sequence ?
- 2.2 What will be the running time for your algorithm ?