Longest Common Subsequence

(and other dynamic programming practice)

10/2/24

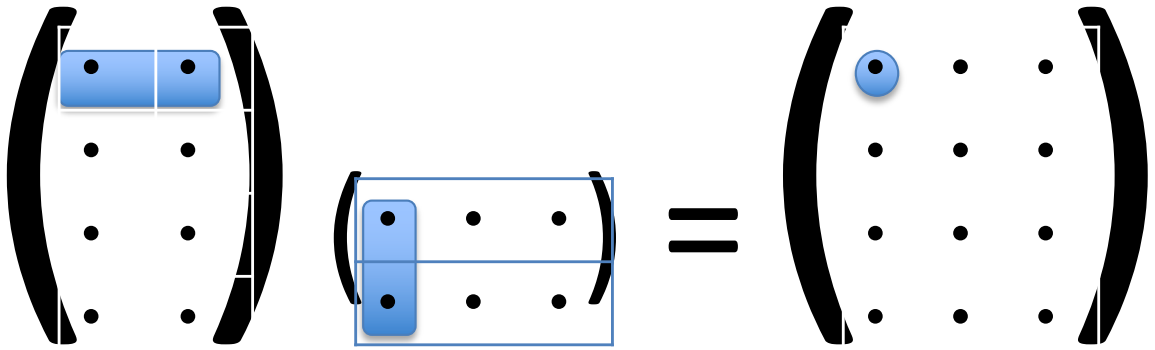
Administrivia

- Read Section 14.2 for Friday

- Exam 1 out today
  - Multi-day takehome, due Tuesday
  - No class tomorrow (10/3)
  - Open notes and book, closed internet and friends
  - Everything thru multithreaded (induction, asymptotic ordering, AVL trees, D&C, multithreaded)

Preview: Matrix chain multiplication

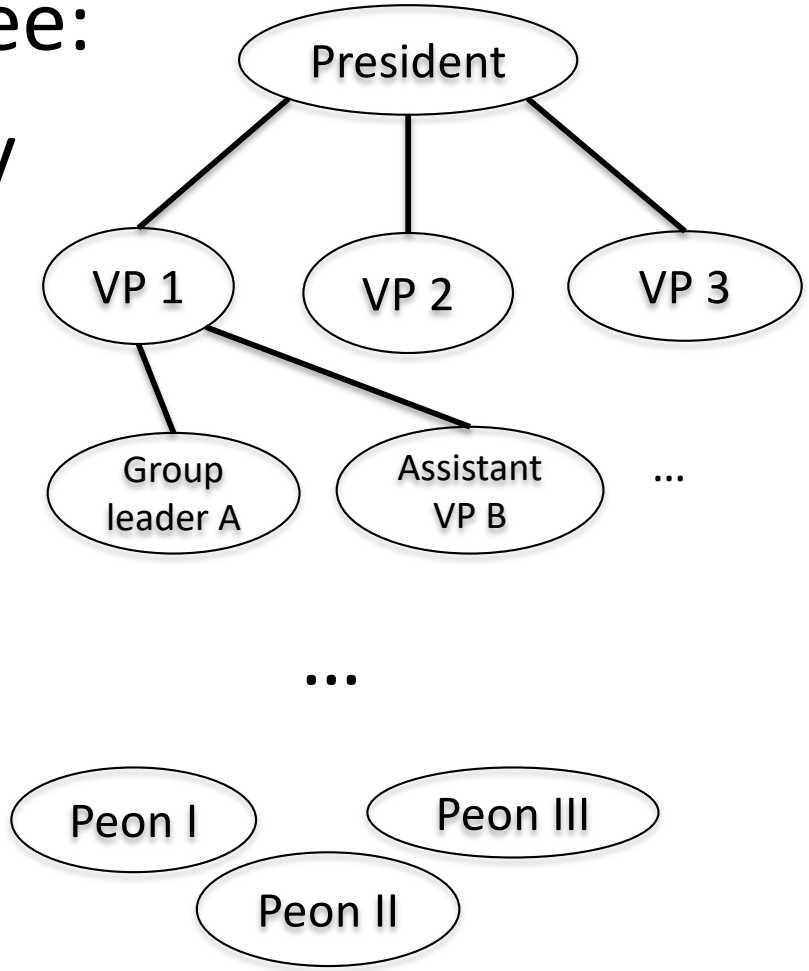
- Can multiply non-square matrices:



- Number of operations = abc (using simple alg)
- How long does it take to multiply a series ("chain") of them?

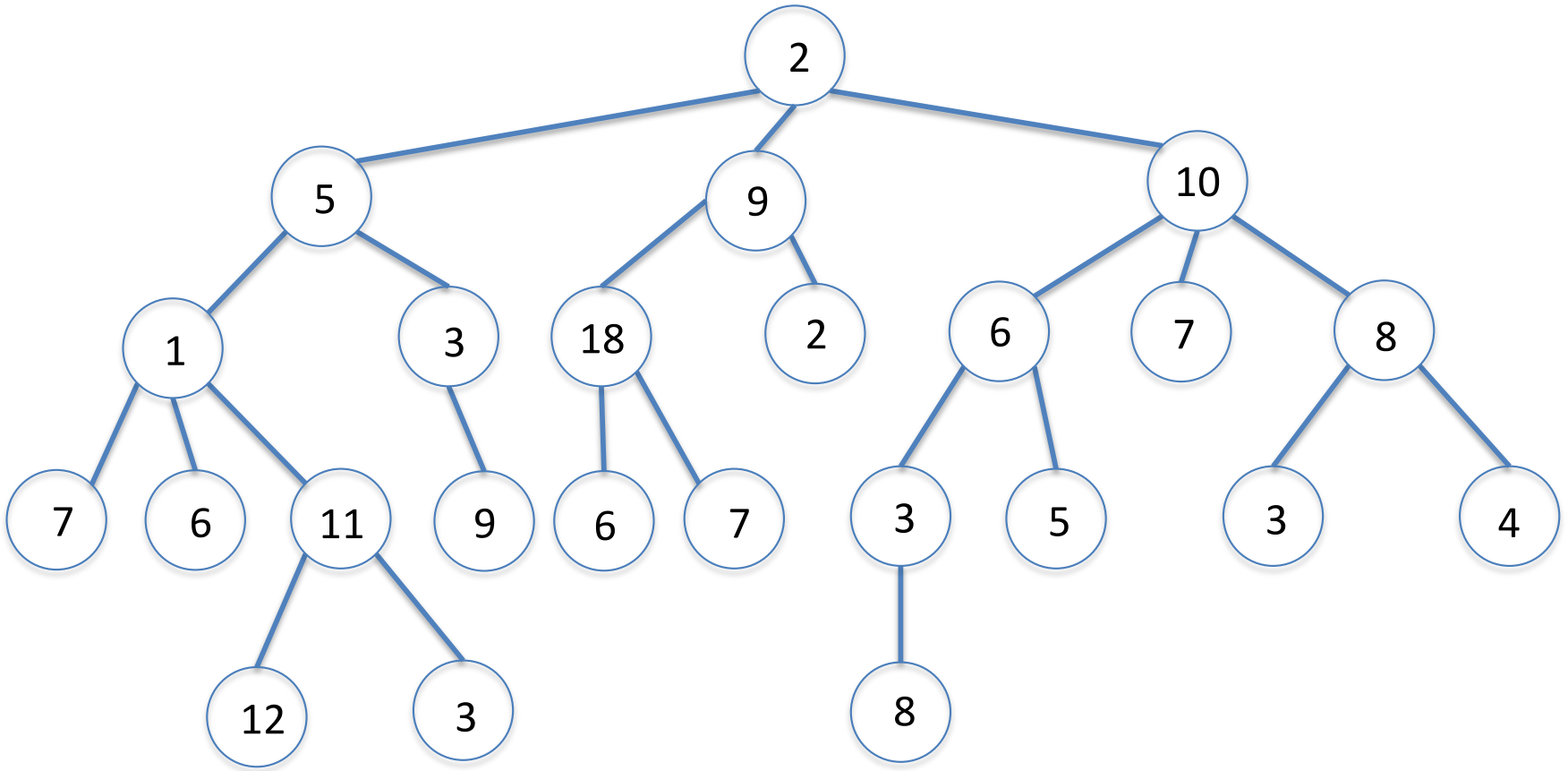
Party planning

- Company hierarchy as a tree:
- Each node has “conviviality rating”, which is how fun that person is at a party
- Want to invite people with maximum sum of ratings, but never invite a person and their immediate boss



C[T] = highest total for subtree T

N[T] = highest total for subtree T w/o the root



Longest common subsequence (LCS)

Given two sequences, what is the longest subsequence that they share? (Taking some values and preserving order)

B, D, C, A, B, A

A, B, C, B, D, A, B

What is the length of the LCS for the sequences below?

A, B, A, C, A, B, C, A, B, A, C

C, A, B, C, C, B, C, B, A

A. 4

B. 5

C. 6

D. 7

E. None of the above

What is the length of the LCS for the sequences below?

A, B, A, C, A, B, C, A, B, A, C

C, A, B, C, C, B, C, B, A

A. 4

B. 5

C. 6

D. 7

E. None of the above

Subproblem

A[i,j] = length of LCS using first i chars of 1st sequence and first j chars of 2nd

A[i,j] = length of LCS using i chars of s and j chars of t

$$A[i,j] = \begin{cases} 0 & \text{if } i=0 \text{ or } j=0 \\ 1+A[i-1,j-1] & \text{if } s[i]=t[j] \\ \max\{A[i-1,j], A[i,j-1]\} & \text{o.w.} \end{cases}$$

	ε	A	B	A	C	A	B	C	A	B	A	C
ε												
C												
A												
B												
C												
C												
B												
C												
B												
A												