

Lecture 14

CSE 331

Mar 3, 2021

CSE 331 Video project choices

Spring 2021

Please check the table below before submitting your video project team composition to make sure your case study is not being used by another group. Case studies are assigned on a first come first serve basis.

Only 165 (of 271) students submitted!

Group	Chosen Algorithm	Case Study	Links
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Theresa Westfall (1-...), Nikh A. Jeyaraj, Of course student reading algorithm needed to remove reading his introduction reading his [Link 1](#)

Due this Friday 8:00pm!

Neppalli Chandra (1-
Series)

[Link 3](#),
[Link 4](#)

Breadth First Search (BFS)

Build layers of vertices connected to s

$$L_0 = \{s\}$$

Assume L_0, \dots, L_j have been constructed

L_{j+1} set of vertices not chosen yet but are connected to L_j

Stop when new layer is empty

Use linked lists

Use $CC[v]$ array

Rest of Today's agenda

Quick run time analysis for BFS

Quick run time analysis for DFS (and Queue version of BFS)

Helping you schedule your activities for the day

$O(m+n)$ BFS Implementation

BFS(s)

Array

Input graph as
Adjacency list

$CC[s] = T$ and $CC[w] = F$ for every $w \neq s$

Set $i = 0$

Set $L_0 = \{s\}$

While L_i is not empty

$L_{i+1} = \emptyset$

For every u in L_i

For every edge (u, w)

If $CC[w] = F$ then

$CC[w] = T$

Add w to L_{i+1}

$i++$

Linked List

Version in KT
also
computes a
BFS tree

All the layers as one

BFS(s)

$CC[s] = T$ and $CC[w] = F$ for every $w \neq s$

Set $i = 0$

Set $L_0 = \{s\}$

While L_i is not empty

$L_{i+1} = \emptyset$

For every u in L_i

For every edge (u, w)

If $CC[w] = F$ then

$CC[w] = T$

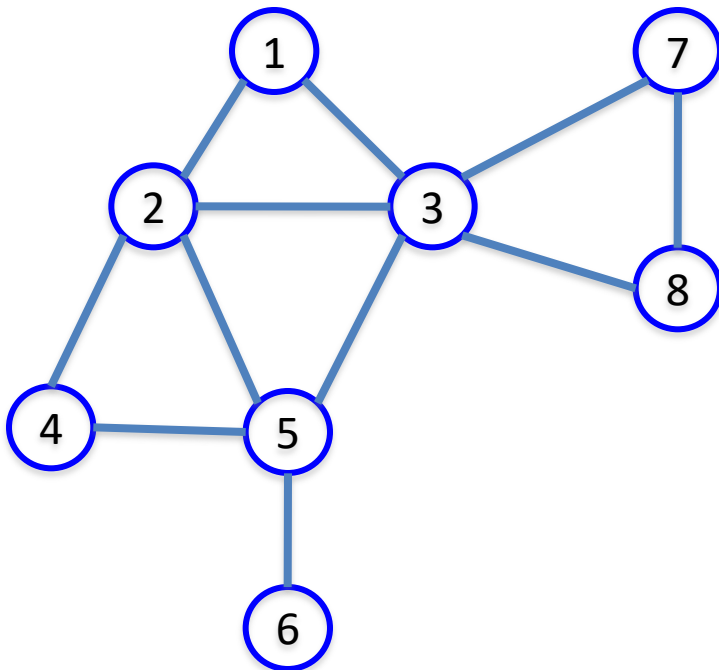
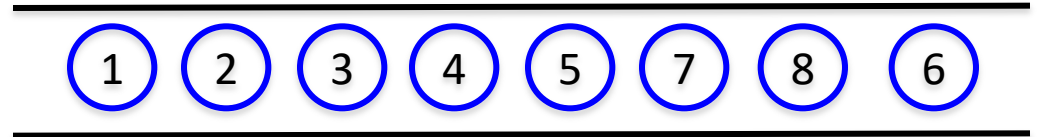
Add w to L_{i+1}

$i++$

All layers are considered in first-in-first-out order

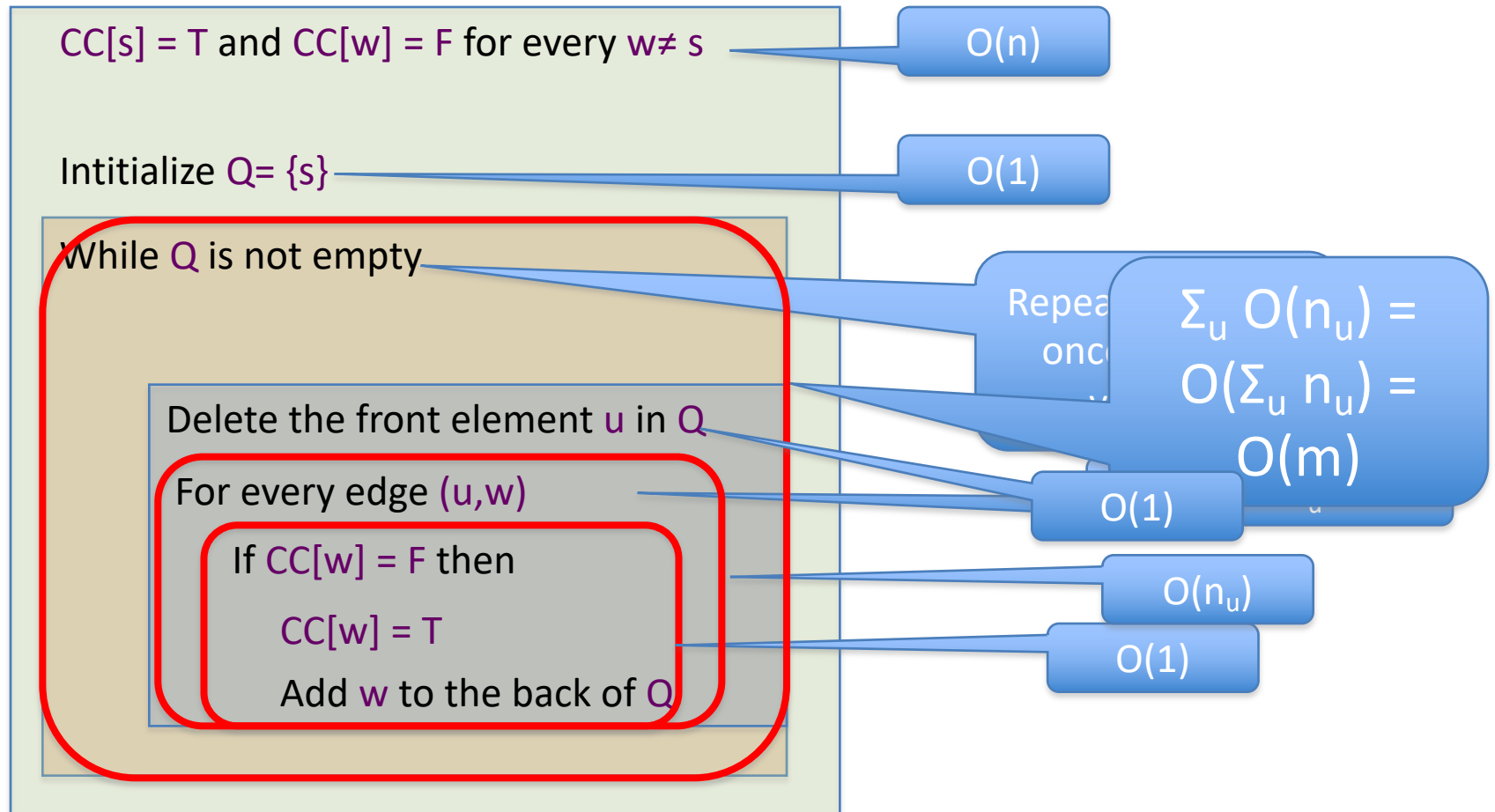
Can combine all layers into one queue: all the children of a node are added to the end of the queue

An illustration



Queue $O(m+n)$ implementation

BFS(s)

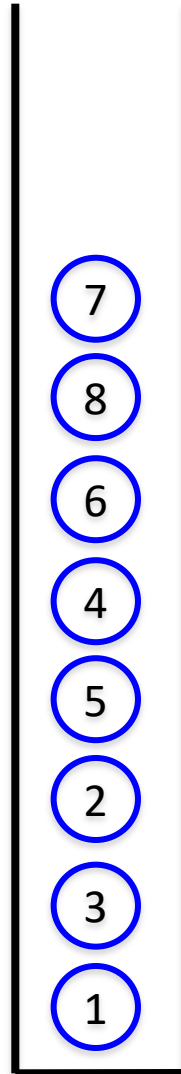
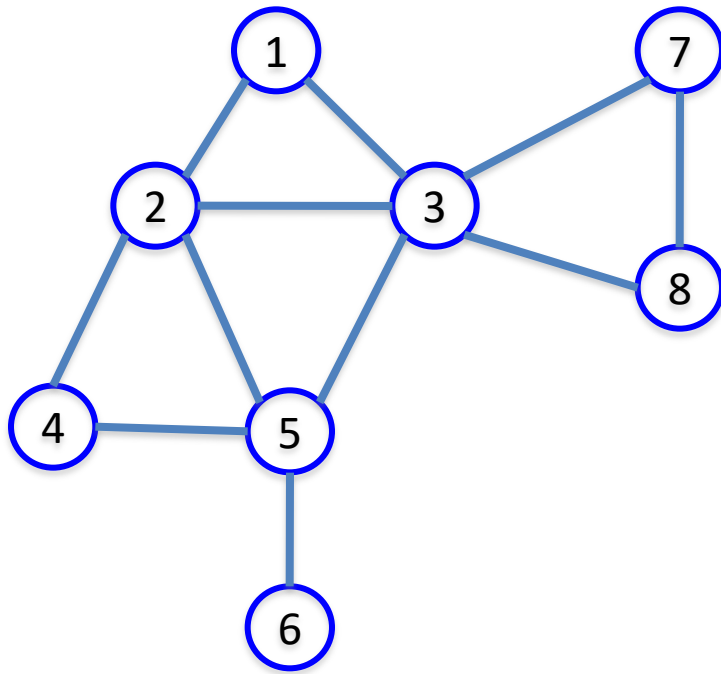


Questions?

Implementing DFS in $O(m+n)$ time

Same as BFS except stack instead of a queue

A DFS run using an explicit stack



DFS stack implementation

DFS(s)

$CC[s] = T$ and $CC[w] = F$ for every $w \neq s$

Initialize $\hat{S} = \{s\}$

While \hat{S} is not empty

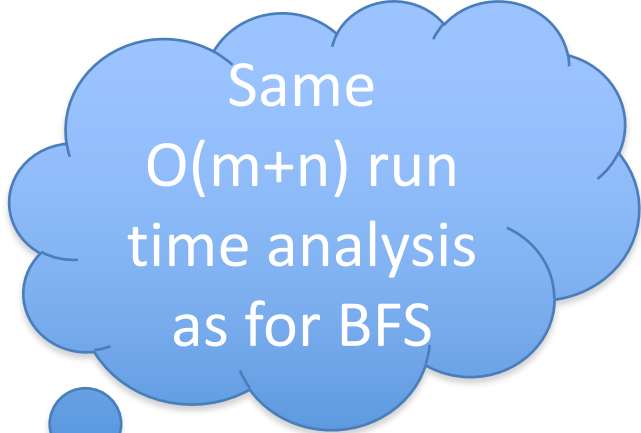
Pop the top element u in \hat{S}

For every edge (u,w)

If $CC[w] = F$ then

$CC[w] = T$

Push w to the top of \hat{S}



Same
 $O(m+n)$ run
time analysis
as for BFS

Questions?

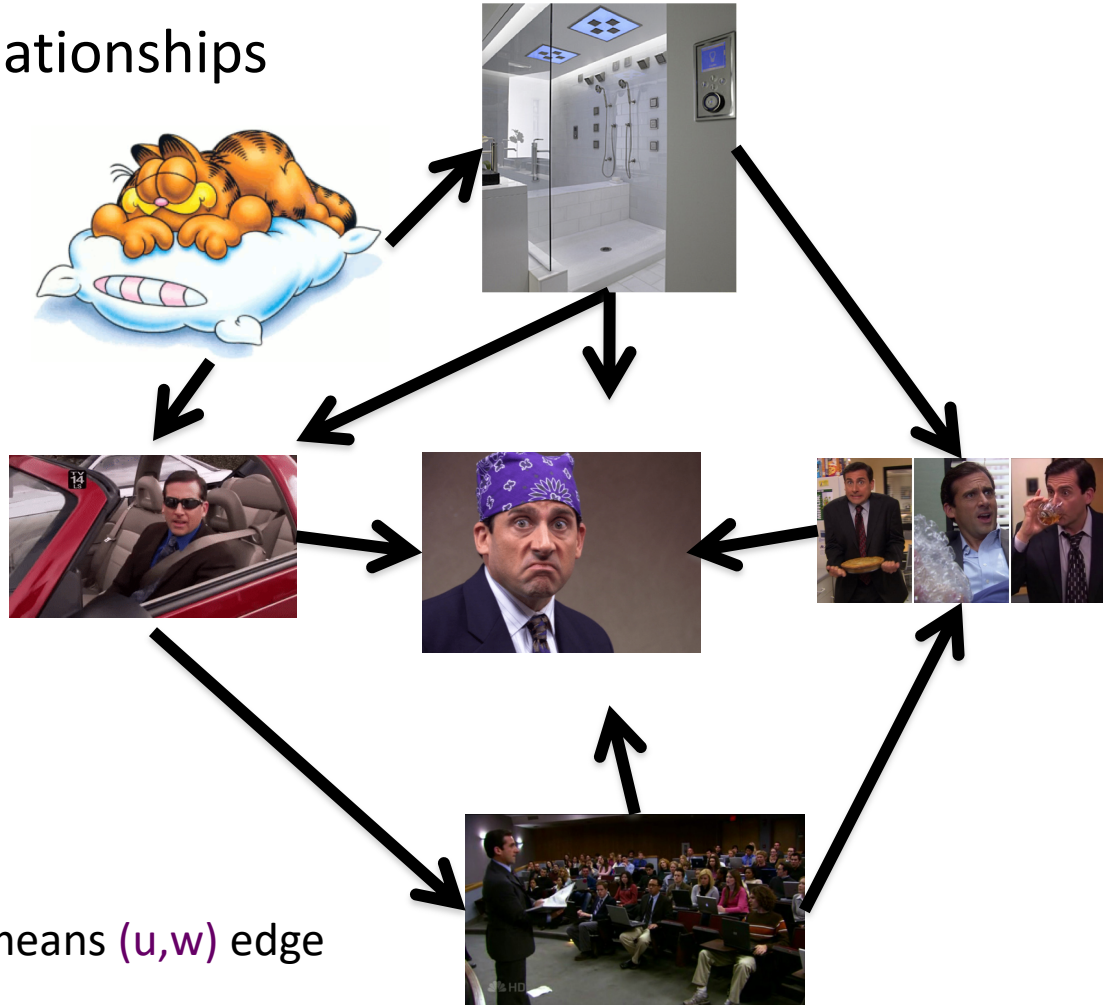
Reading Assignment

Sec 3.3, 3.4, 3.5 and 3.6 of [KT]

Directed graphs

Model asymmetric relationships

Precedence relationships

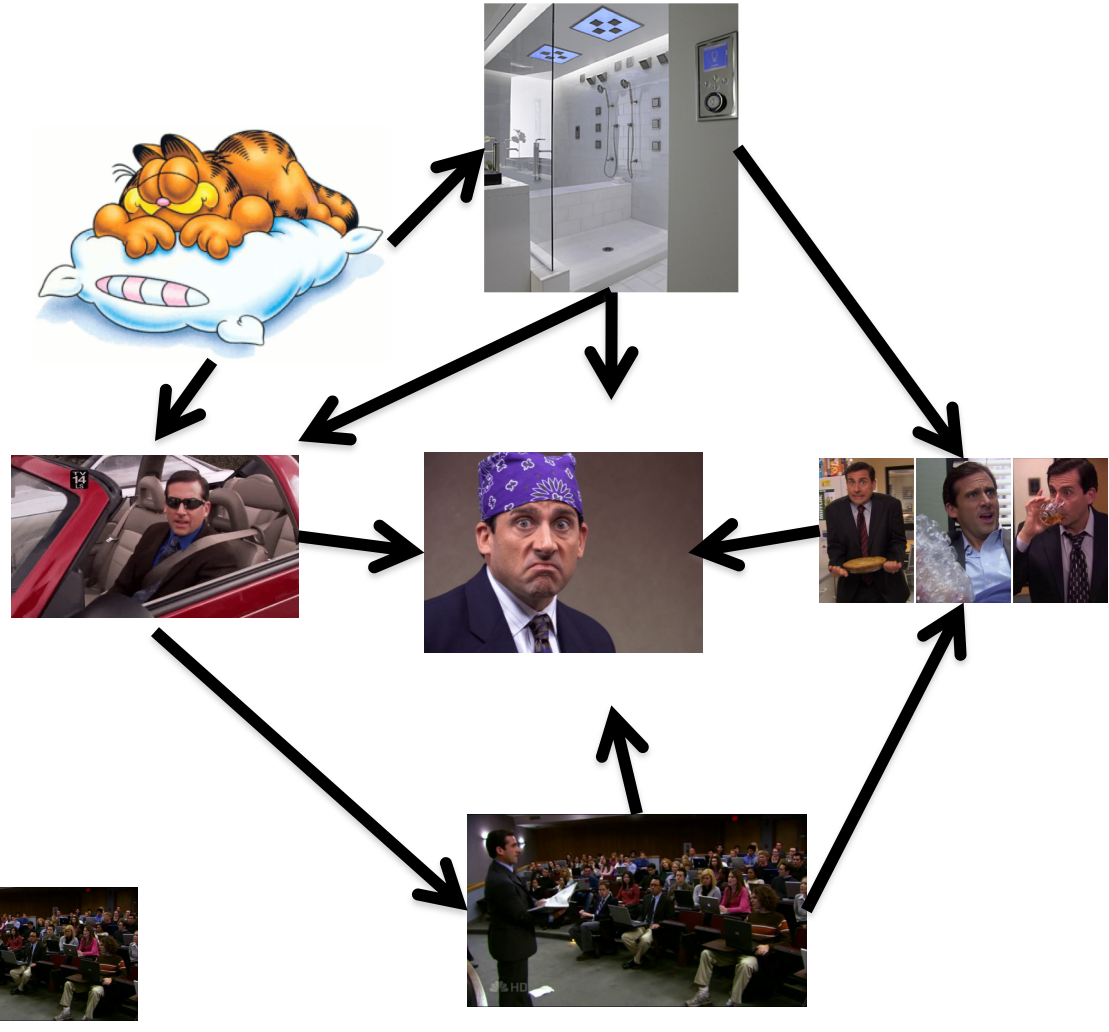


u needs to be done before w means (u,w) edge

Directed graphs

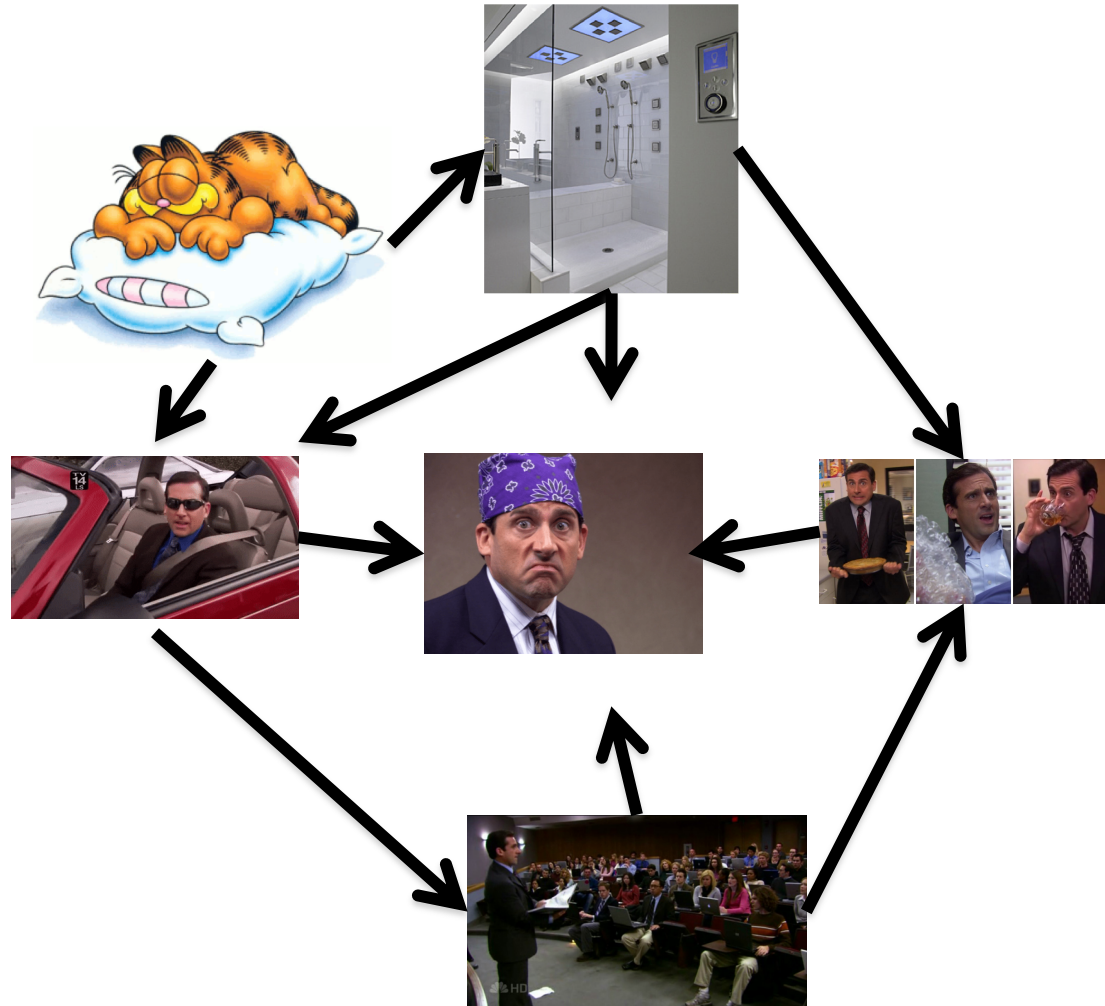
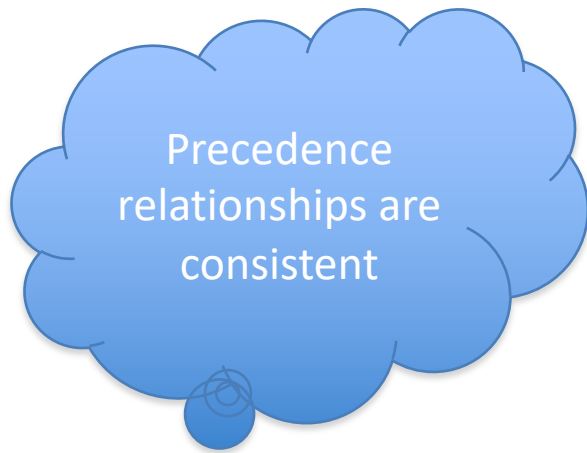
Adjacency matrix is not symmetric

Each vertex has two lists in Adj. list rep.



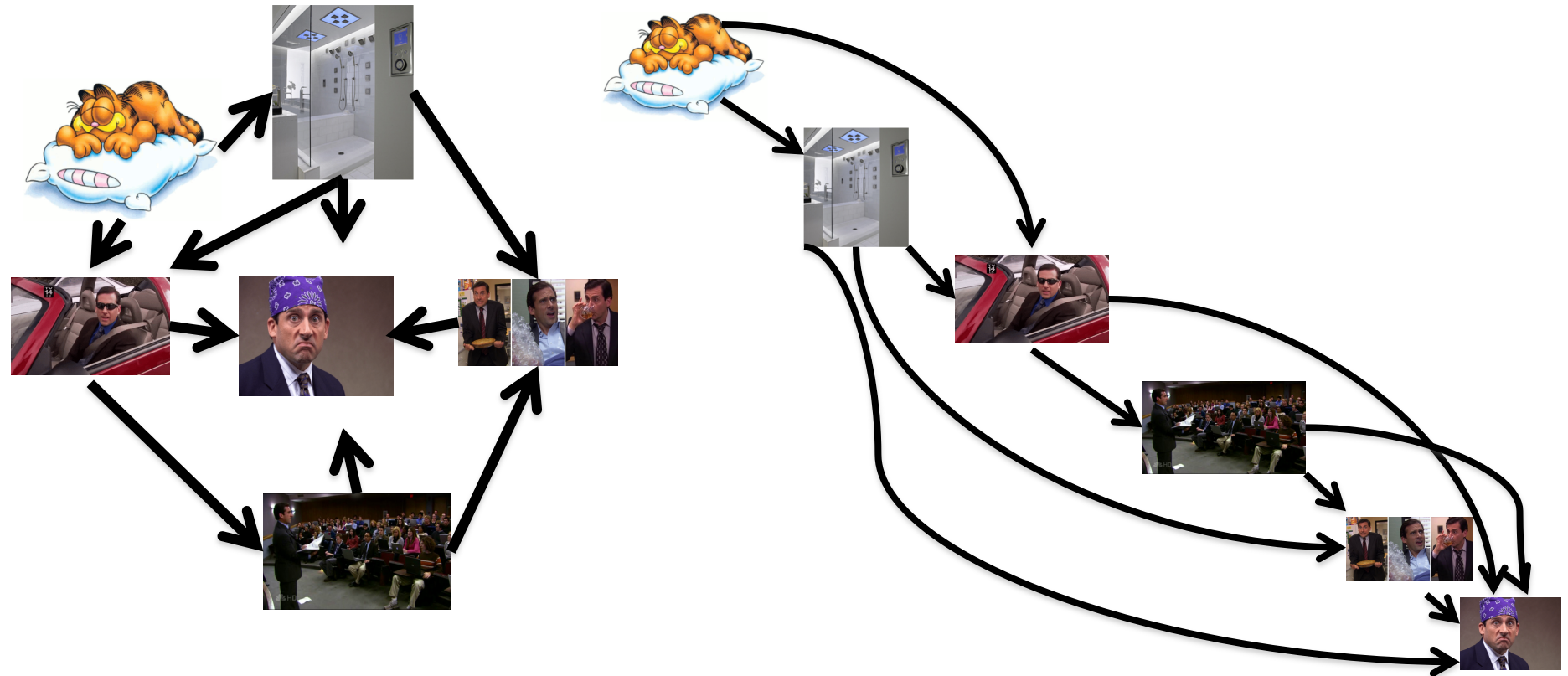
Directed Acyclic Graph (DAG)

No directed cycles



Topological Sorting of a DAG

Order the vertices so that all edges go “forward”



More details on Topological sort

Topological Ordering

This page collects material from previous incarnations of CSE 331 on topological ordering.

Where does the textbook talk about this?

[Section 3.6](#) in the textbook has the lowdown on topological ordering.

Fall 2018 material

First lecture

Here is the lecture video:

CSE331 on 10/1/2018 (Mon)



Questions?