Slide 1

Mathematics for Computer Science
MIT 6.042J/18.062J

Directed
Acyclic Graphs
(DAGs)

Slide 2

EECS 6-3

project: 1/2+1/2
advanced: 2
lab: 1
header: 3
foundational: 3
introductory: 2
math: 2
18.03/06 + 6.042

Slide 3
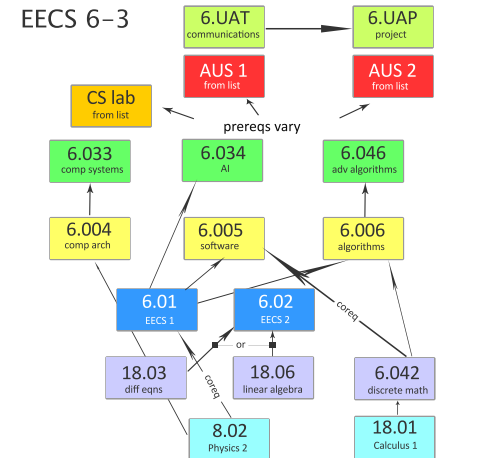
indirect prerequisites

u is indirect prereq of v
when there is a sequence
of prereq's from u to v

Slide 4

indirect prerequisites

u is an indirect prereq of v
just means that there is a
positive length walk from
u to v in the 6-3 digraph D:

$$u\ D^+\ v$$

1

Closed walks

Closed walk starts & ends at the same vertex.

How long does it take to graduate if there is a closed walk starting at 6.042? (There is a faculty committee that checks for this kind of thing.)

Cycles

A cycle is a closed walk whose only repeat vertex is its start.
A vertex alone is a length-0 cycle

Cycles

$v_0 \quad v_1 \quad v_2 \quad \ldots \quad v_{n-1} \quad v_0$

v_i

v_{i+1}

v_0
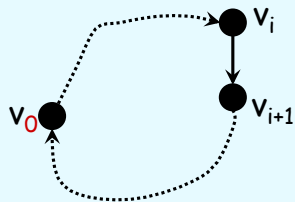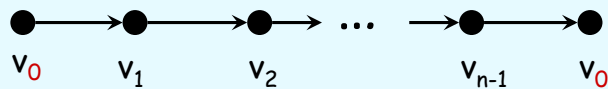
Closed Walks

Lemma: Shortest positive length closed walk from v is positive length cycle from v!

Proof: like shortest walk is a path

Directed Acyclic Graph
DAG
has no positive

length cycle

(or closed walk)

Directed Acyclic Graph
examples:

prerequisite graph

$n \longrightarrow n+1$ successor

$\{a,b\} \longrightarrow \{a,b,d\}$ $\subset$
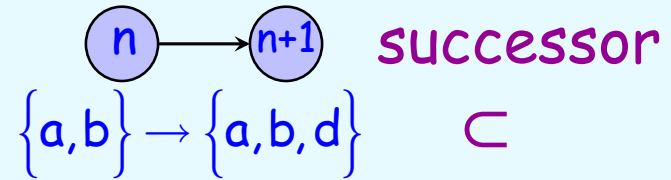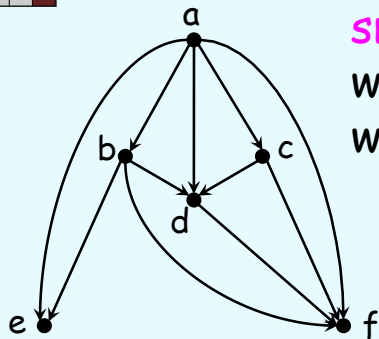
DAG walk relation

smallest DAG with same walk relation?

Covering Edges
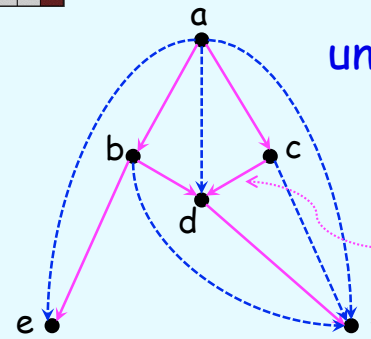
unneeded edges

any path from c to d must use c→d