DAG's & Scheduling

indirect prerequisites

u is an indirect prereq of v when there is a positive
length path from u to v in the prerequisite digraph R:

\[ u \rightarrow^{+} v \]

Some Course 6 Prerequisites

18.01 → 6.042  
18.01 → 18.02  18.03, 6.002 → 6.004  
18.01 → 18.03  6.001, 6.004 → 6.033  
6.001 → 6.034  6.033 → 6.857  
6.042 → 6.046  6.046 → 6.840

a minimal subject?

a minimal subject has no prerequisites --a Freshman subject

nothing → d
minimum means earliest of all:
an indirect prereq. of everything
none in this example
there used to be one at MIT:
orientation week seminar on
summer book assignment

Constructing a Term Schedule

18.01  8.02  6.001

start schedule with them

Some Course 6 Prerequisites

18.01 → 6.042  8.02 → 6.002
18.01 → 18.02  18.03, 6.002 → 6.004
18.01 → 18.03  6.001, 6.004 → 6.033
6.001 → 6.034  6.033 → 6.857
6.042 → 6.046  6.046 → 6.840

identify minimal elements

Some Course 6 Prerequisites

18.01 → 6.042  8.02 → 6.002
18.01 → 18.02  18.03, 6.002 → 6.004
18.01 → 18.03  6.001, 6.004 → 6.033
6.001 → 6.034  6.033 → 6.857
6.042 → 6.046  6.046 → 6.840

remove minimal elements
Some Course 6 Prerequisites

- 6.042 → 6.002
- 18.02, 18.03, 6.002 → 6.004
- 18.03 → 6.004 → 6.033
- 6.034 → 6.033 → 6.857
- 6.042 → 6.046 → 6.840

remove minimal elements

Some Course 6 Prerequisites

- 6.042 → 6.002
- 18.02, 18.03, 6.002 → 6.004
- 18.03 → 6.004 → 6.033
- 6.034 → 6.033 → 6.857
- 6.042 → 6.046 → 6.840

identify new minimal elements

Constructing a Term Schedule

- 18.01
- 6.001

schedule them next

Constructing a Term Schedule

- 18.01
- 6.001

continue in this way...
complete term schedule

an antichain

a set of subjects with no indirect prereqs among them
-- so can be taken in any order
-- called "incomparable"

Def: \( u \) is incomparable to \( v \) iff

no path from \( u \) to \( v \)
no path from \( v \) to \( u \)

some antichains

many more...
a leisurely schedule

Graduate taking only 1 subject/term?

Sure,

18.01 6.001 6.003 6.004 6.043 6.042 18.02 6.002

6.046 6.033 6.840 6.857

a topological sort

a chain

sequence of subjects that must be taken in order (subjects are comparable)

some chains

some chains
some chains

\[
\begin{align*}
8.02 & \quad 6.004 \\
6.85 & \quad 6.04
\end{align*}
\]

still a chain

maximum length chain

\[
\begin{align*}
18.01 & \quad 6.043 & \quad 18.03 & \quad 6.003 & \quad 6.034 \\
18.02 & \quad 6.046 & \quad 6.03 & \quad 6.843 & \quad 6.03 \\
 & \quad 6.046 & \quad 6.03 & \quad 6.843 & \quad 6.03 \\
6.042 & \quad 6.001 & \quad 6.034 & \quad 6.002 & \quad 6.004
\end{align*}
\]

how many terms to graduate?

5 terms are \textbf{necessary} to graduate -- because max chain length is 5 and 5 are \textbf{sufficient} -- if you can take unlimited subjects per term...

...sufficient

heavy term: 5 subjects
reduce the term load

at most 4 subjects/term

3 Subjects per Term Possible