ICS 175A - Constraint Networks, Fall 2001

Graph related projects

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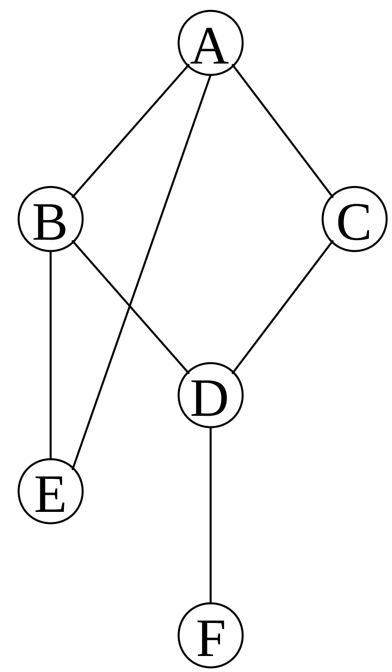
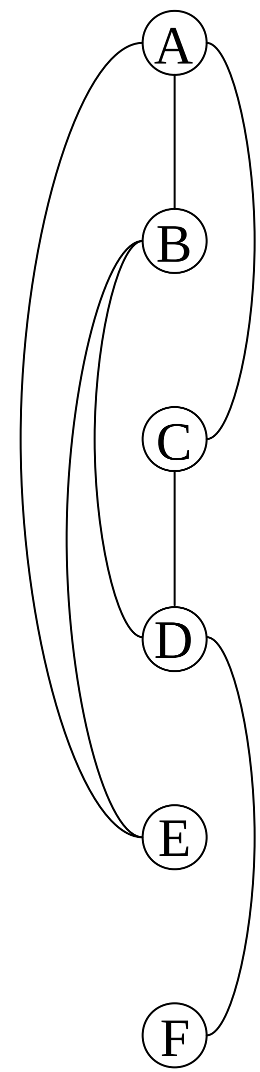
G=(V,E) a graph

(G,d) an ordered graph

e.g. *d*=(F,E,D,C,B,A)

(bottom up)



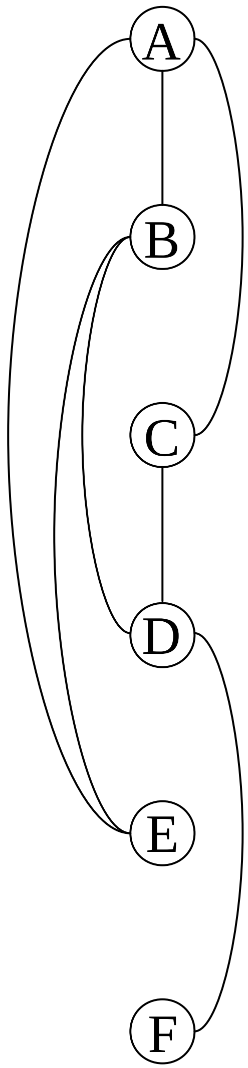


d=(F,E,D,C,B,A)

width of a node = number of parents in an ordered graph

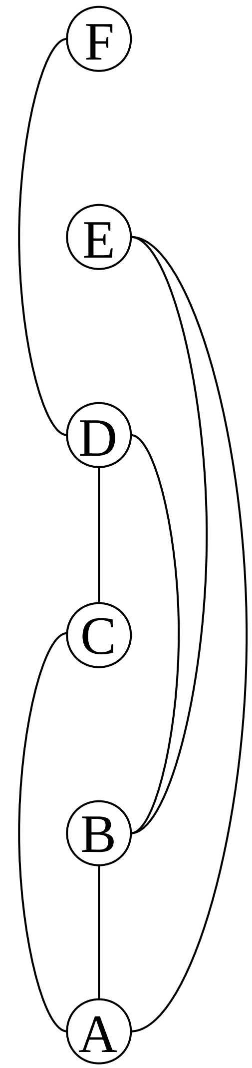
width of an ordering = w(d) is the maximum width over all nodes

The ordering is important



d=(F,E,D,C,B,A)

$w(d)=3$



d=(A,B,C,D,E,F)

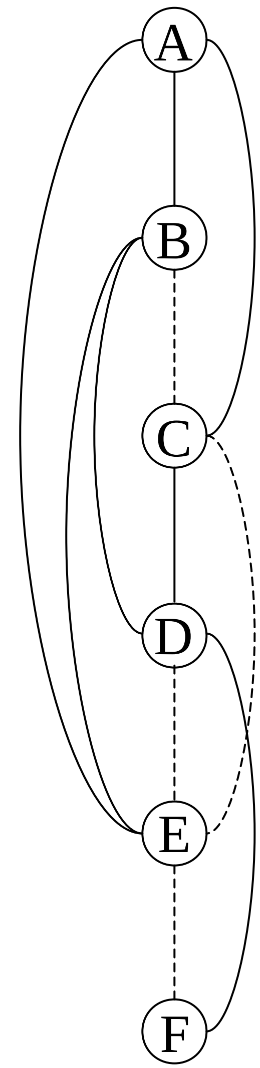
$w(d)=2$

Induced graph - with respect to ordering *d*

Process nodes from last to first (top to bottom)

Connect all parents of the current node

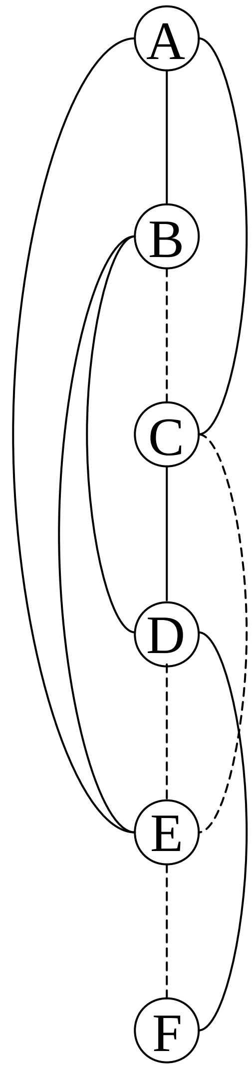
Induced width of the ordered graph, w(d),* is the width of the induced ordered graph



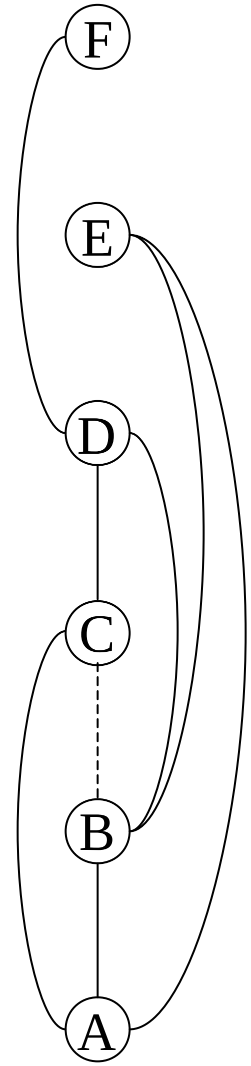
*Induced width of a graph, w**

is the minimal induced width
over all its orderings

Finding the induced width of
a graph is hard (NP-complete)



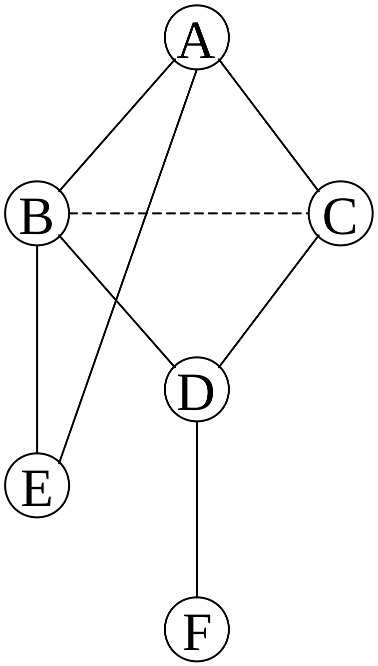
w(d1) = 3*



w(d2) = 2*

Chordal Graphs

A graph is *chordal* if every cycle of length four or more has at least one chord, i.e. an edge joining two nonconsecutive vertices along that cycle



Chordal Graphs

Several graph problems become easy on chordal graphs:

- computing the induced width
- finding the maximal cliques

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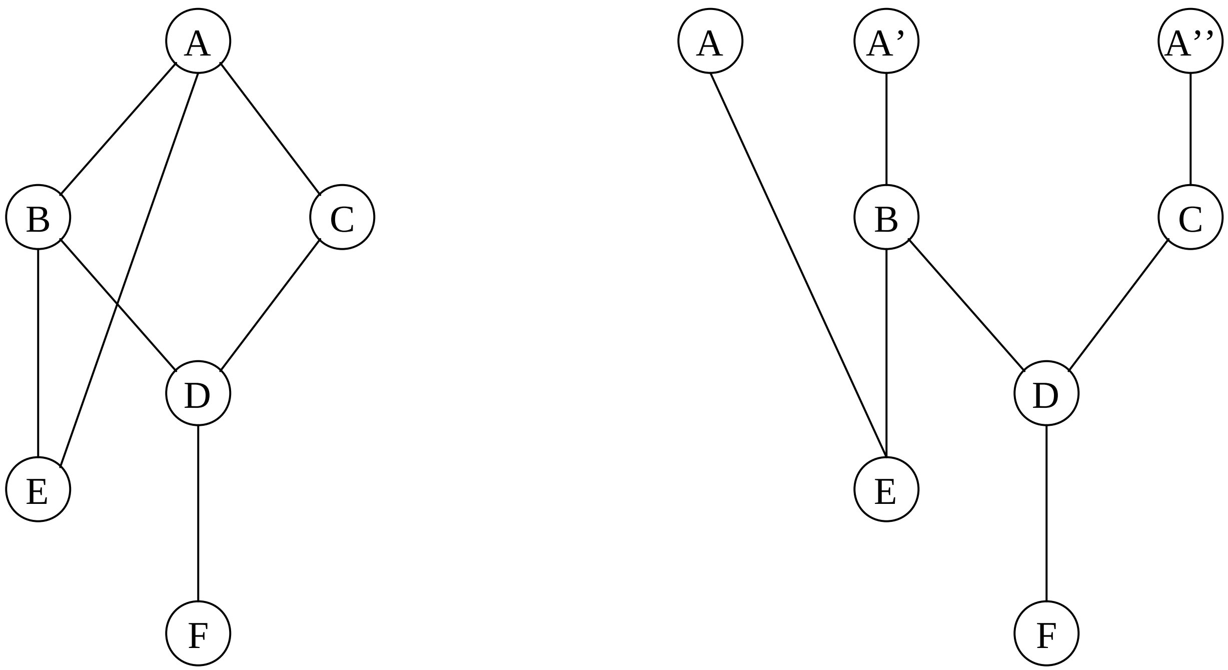
Good orderings for graphs are related to good triangulations

Cycle cutset

Cycle cutset = subset of vertices that cut all the cycles in the network



Project 1 - triangulation algorithms

Possible projects:

- implement different approximation methods (greedy methods, local search methods) for induced width; compare and report results on different benchmarks and randomly generated networks

- find good triangulations: implement recently developed techniques for graph preprocessing; use existing algorithms for triangulation; compare and report results on different benchmarks and randomly generated networks

- come up with your own variations

Project 2 - cycle cutset

Finding a loop cutset is the first step in Pearl’s method of conditioning for inference.

The method is still exponential in the size of the cycle cutset, therefore a minimal cutset is desirable

- implement existing approximation algorithms and report experiments
- implement random algorithms for the cycle cutset problem
- come up with related problems