

Graph Drawing

Tree connected acyclic graph

rooted tree tree T w/ a distinguished vertex $r \in T$
call r the root

Let T be a rooted tree w/ root r

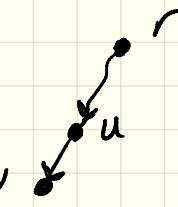
$$(u, v) \in T$$

u is the parent of v

v is the child of u

leaf is a

vertex w/o a child

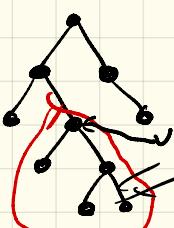
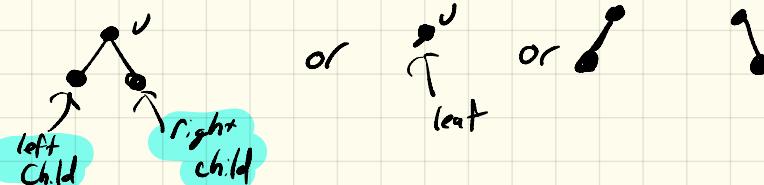


Ordered tree a rooted tree T

s.t. $\forall u \in T$ the children of u are ordered

binary tree each vertex has at most 2 children

(assume ordered)



subtree is subgraph induced by all vertices w/ paths originating from u to root v



depth is # of edges in T between v and root

height is max depth of verts in T

Layered drawing

of a rooted tree

w/ vertex $v \in T$ w/ depth i_v
draw v w/ y-coord of $-i_v$

\Rightarrow in a layered

drawing we get planarity
by ensuring that for
 $v', v'' \in T$ on layer L_i

their children u', u'' (resp)

the order on L_{i+1} is same as parents

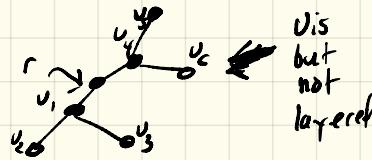
i.e.

$$\text{sign}(x(u'') - x(u')) = \text{sign}(x(u'') - x(u'))$$

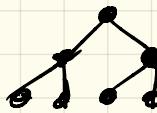
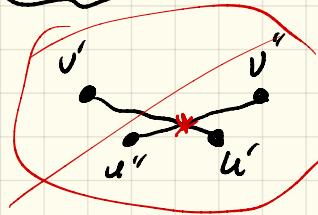
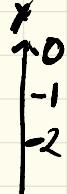
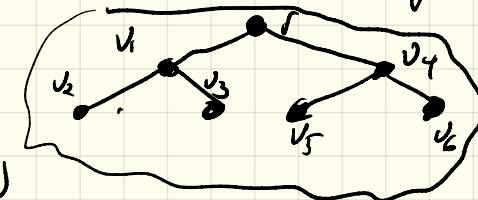
\Rightarrow we only need to compute
layer and x-coord

Layered Tree Draw algo DTC

- local opt heuristic w.r.t. reduce tree width
- center parent w.r.t. children



↓ layered drawing



LayeredTreeDraw(T, r)

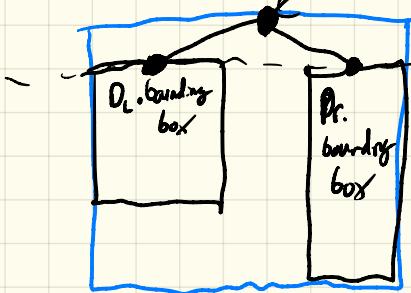
if $r == T$
return draw vertex

$D_L = \text{LayeredTreeDraw}(r.\text{leftSubtree}, r.\text{left})$

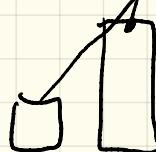
$D_R = \text{LayeredTreeDraw}(r.\text{rightSubtree}, r.\text{right})$

□

Layout tree r



align tops
of bounding boxes



Return layout

Note: 2nd pass pre-order traversal to assign coordinates

⇒ Let T be a rooted binary tree of n verts

Alg LayeredTreeDraw constructs a drawing Γ of tree T in $O(n)$ time ⇒

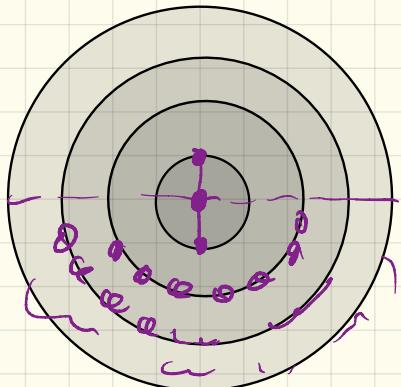
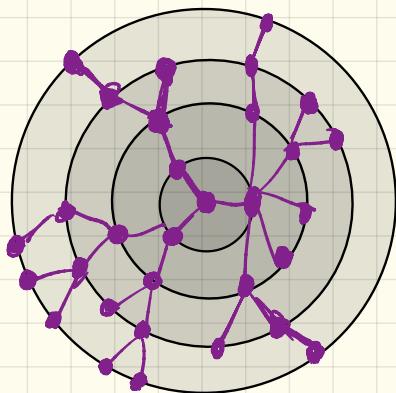
1. Γ is a layered drawing
2. Γ is planar, straight line, and strictly downward
3. Γ is embedding preserving! left-right child ordering of verts is preserved
4. Γ is well spaced: $u, v \in T$ distance between drawing of u, v is at least 1
5. area of Γ is $O(n^2)$
6. x-coord of parent w/ 2 children is avg of x-coords of children

31.3 radial drawing

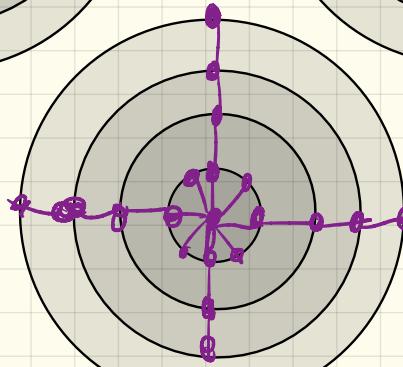
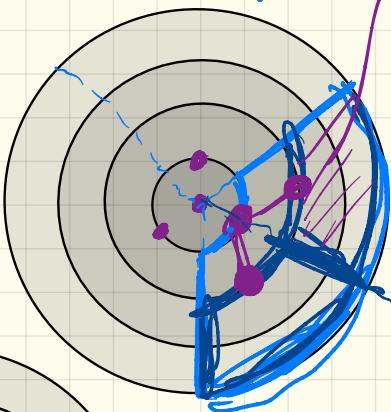
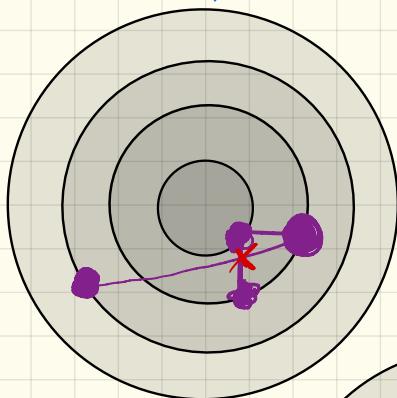
a layered drawing

w/ root at the origin

and layers as concentric circles



Adapt Layered TreeDraw to a radial drawing



lots of
wasted space