Robert Bryant & Kevin Wang: Avuncular Fun
- given set $S$ of nodes, root $r \in S$
- build tree on $S$
  to minimize $\sum_{v \in T} \text{depth}(v) \cdot \text{key}(v)$

where $\text{key}(v) =$ # children of $v$
  or arbitrary pos. int. if
  # children is fixed

- Avuncular property:
  $\forall v, w: \text{key}(v) \leq \text{key}(w) \Rightarrow \text{depth}(v) \leq \text{depth}(w)$

- Problem 1: fixed branching factor
  - $O(\lg^2 n)$ w.c. insertion/deletion to $S$
  - $O(1)$ space/node
  - $O(\lg n \lg \lg n)$ amortized via indirection
  - $O(\lg n)$ via clever indirection

- Problem 2: variable branching factor
  - seems difficult because of holes
  - lower bound?
Katherine Lai: Cyclic Union-Split-Find

- union-find: \( \Theta(\alpha(n)) \)
- union-split-find = predecessor with \( u = n \)
  = \( \Theta(\log n) \)
  
  on intervals

- cyclic union-split-find:
  chords in polygon or balanced parens.
  \( (())((()))() \)

- split = insert
- union = delete
- find = faces on either side of edge

- known: \( \Omega(\log \log n) \)
- NEW: \( O(\log \log n) \)

- based on strongly weight-balanced B-tree
  with branching factor \( w \in \)
Worm Detection DSs

- Worms are fast (minutes!)
- Need automated detection/response
- Content-based detection: $k$ bits
  - FPGA to compute hash on 80-bit sliding window of streaming data
  - Signature over random combinations
  - Worm “fingerprinting”
- Rabin-Karp fingerprinting
- Bitmap DS to decrease memory and accuracy
Galen Pickard: Gov't R&D on MST Algs.
- Lincoln Labs: Stellar: system for instruction via hierarchical clustering
  essentially MST, but dynamic
  - $O(n^2)$ via trivial rebuilding of MSTs
  - $O(n^{1.2})$ average case [prior work]
  - $O(n \log n)$ via Holm et al. dynamic MST

IMPLEMENTATION
Anders Kaseorg: Fully Persistent Arrays
  = fully persistent RAM DS
  - $O(lg lg m)$ lookup, $O(lg lg m)$ expected amortized, $O(m)$ space [Dietz-WADS 1989]
  - Euler tour on version tree
  - order query DS on Euler tour, $O(1)/op.$
  - yEB or y-fast trees for predecessor on (index, version) pairs $\Rightarrow O(lg lg m)$
  - order query DS changes tags which incurs updates in pred. ~ouch
  - both order query & y-fast DSs use indirection with $lg n$ chunks @ bottom
  - mix tops & bottoms separately

READING
Hui Tang: sculpture
- 8-way branching factor B-tree, depth 4
≈ 40 hours, 150 ft dowels
≈ $150
- star of 4
  from center,
  H's to connect
to centers of
  8 subcubes
Mashhood Ishaque: Half-plane Proximity Queries

- preprocess set of points
- query: given point & half-plane, find nearest point in half-plane
- want: $O(n^2)$ preproc. & space $\log n$ query for diameter MST

-known:
  - simplicial partitioning [Daescu et al.-CGTA 2005]
    $O(n)$ preproc. & space $O(n^{1/2+\epsilon})$ query
  - points in convex position:
    $O(n \log n)$ preproc. & space $O(\log^2 n)$ query
    poly. preproc., $O(n)$ space, $O(\log n)$ query

- idea: look at dual arrangement
  $\Rightarrow O(n^3)$ preproc. & space, $O(\log n)$ query (general pt. set)

- minor improvements so far; hope to get down to $O(n^2)$.

RESEARCH