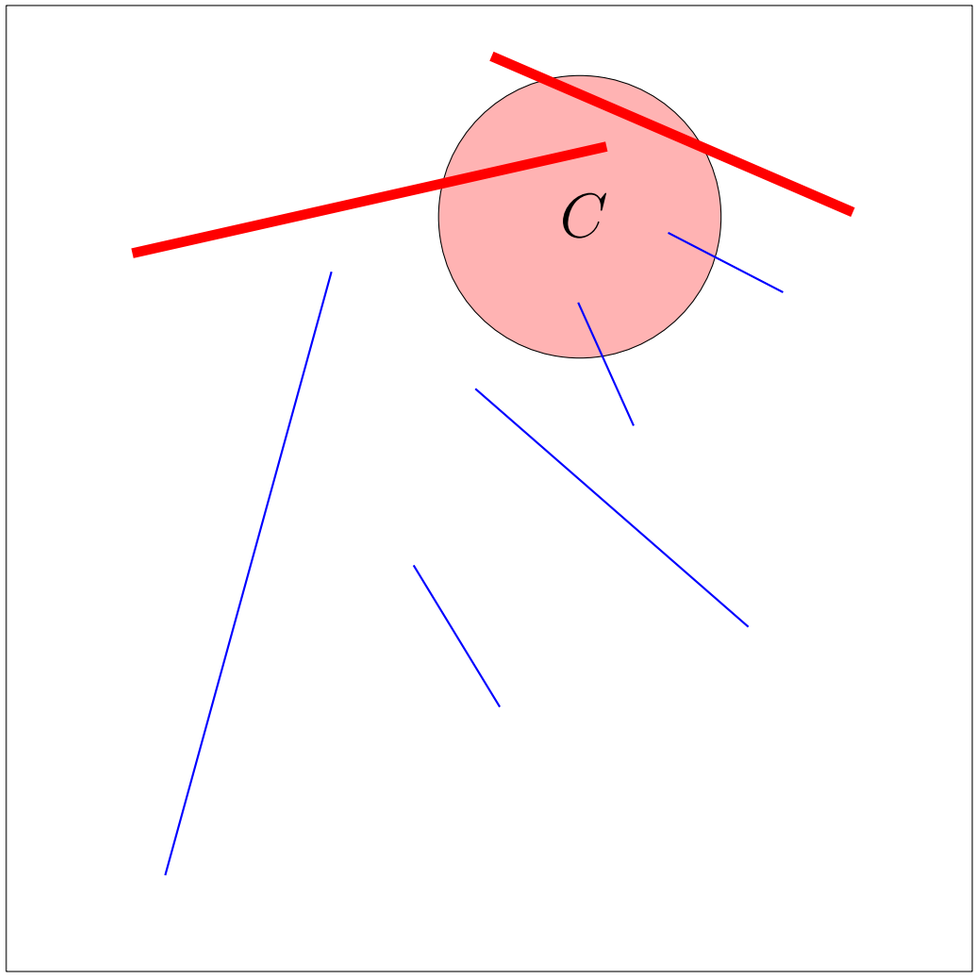
How to get that quadtree in Z-order (for line segments in unit square)

Input: file with for each line segment its endpoints.

Algorithm:

1. Sort bounding box vertices of line segments
   into list $L = \{L_1, ..., L_m\}$ in Z-order
2. For $i \leftarrow 1$ to m:
   - find smallest cell Q that contains L_i and L_{i+1};
   - output cell boundaries of Q and its subquadrants
3. Sort cell boundaries in Z-order (removing duplicates)
4. Put line segments in cells



To prove for input of n line segments:

(compressed)

- together cell boundaries form quadtree subdivision of unit square;
- $O(1)$ line segments per cell;
- $O(n)$ cells in total;
- algorithm runs in $O(sort(n))$ I/O's

Works if line segments have *low density*:
for every circle C of diam d,
#line segments longer than d that intersect C
is at most a constant independent of n