

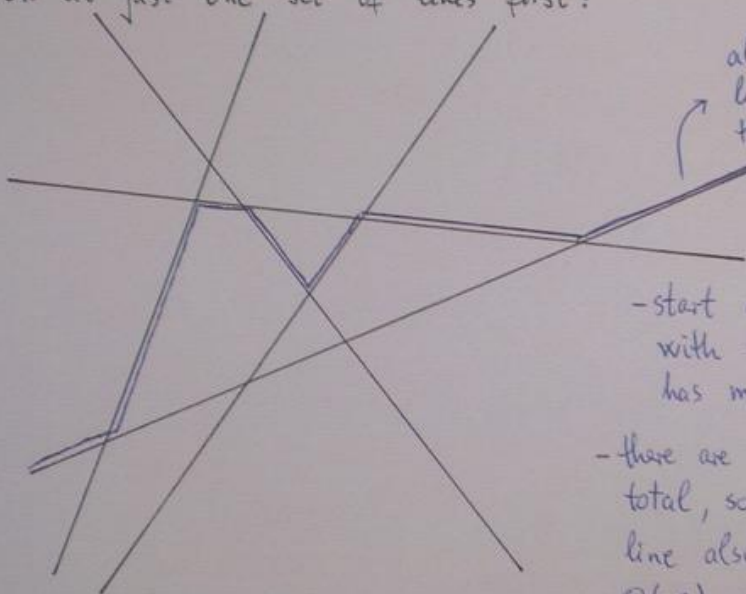
Exercises for Unit 33

- ① a) $2k+1$ red points $\rightarrow 2k+1$ red lines
 $2k+1$ blue points $\rightarrow 2k+1$ blue lines

wanted to find a line
defined by two points s.t.
half of the points lie above
and half below

want to find a point
defined by two lines s.t.
half of the lines are above
and half below

look at just one set of lines first:



all points on this
line have the property
that half of the
lines are above
and half below

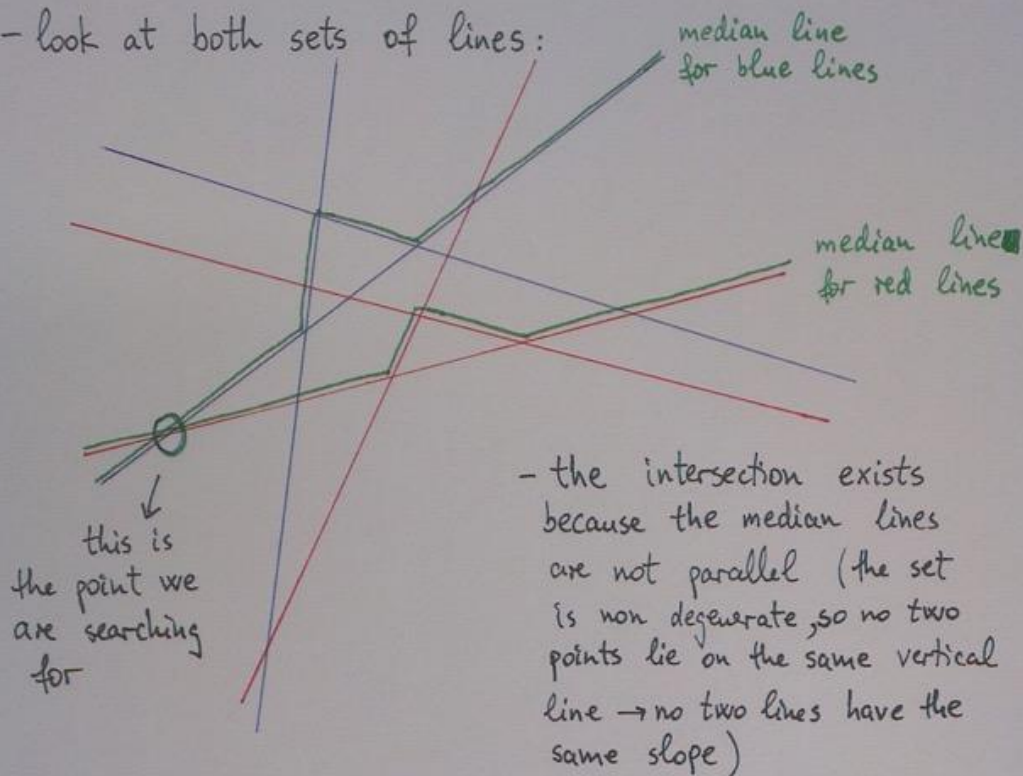
- start and end
with the line that
has median slope

- there are k^2 edges in
total, so this median
line also has at most
 $O(k^2)$ segments

- explicitly finding the median line:

- start with the median slope and every time my line is intersected
I have to switch to the other line if I want to maintain
the median property (but I keep walking in the same x-axis
direction) \rightarrow if I have the line arrangement representation
from class (constructed in $O(k^2)$ time), this we can do in $O(k^2)$
time \rightsquigarrow constant time \cdot number of segments

- look at both sets of lines:



- the intersection exists because the median lines are not parallel (the set is non degenerate, so no two points lie on the same vertical line \rightarrow no two lines have the same slope)

b) getting the representation for one set of lines - $O(k^2)$
finding the median line - $O(k^2)$
we can do a linear scan over the two median lines
to find an intersection - $O(k^2)$
 \Rightarrow total = $O(k^2)$