Exercises for Unit 33

1. Let R be a set of $2k+1$ red points in the plane and let B be a set of $2k+1$ blue points. Assume that $R \cup B$ is in non-degenerate position, i.e. no 3 points lie on a common line and no 2 points lie on the same vertical line.

   a) Prove that there is a red point $r \in R$ and a blue point $b \in B$ such that the line ℓ through r and b simultaneously halves R and B, i.e. there are k red points and k blue points on each side of ℓ.

   b) Design an $O(k^2)$ time algorithm that given R and B constructs such a simultaneous halving line ℓ.

   Hint: It is helpful, if you first formulate this problem in the dual version. Can you give a description of all the halving lines of R? And analogously for B?