

# Homework 2

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Colleagues we collaborated with:

- a
- b

## Problem 1

**Problem 2** Given a set  $C$  of  $n$  circles in the plane, each specified by its radius  $r$  and the coordinates of its center  $(x, y)$ , we set out to find a minimum set of rays from the origin  $(0, 0)$  that will intersect every circle.

- (a) We define a circle's *angular range* to be the angles at which a ray fired from the origin will intersect that circle. We define a circle's *highest angle* as the highest angle in its angular range (with respect to a ray that we define as having angle 0, with angles increasing in a counterclockwise direction).

Given the condition that there exists a ray from the origin which does not intersect any circles in  $C$ , we can define the following algorithm.

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**Algorithm 1**

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Set a ray from  $(0, 0)$  which does not intersect any circles in  $C$  to be angle 0.  
 $L \leftarrow C$  sorted by highest angle  
 $m \leftarrow 0$   
**while**  $L$  is not empty **do**  
    Shoot ray  $R_m$  at highest angle of first circle in  $L$   
    Delete from  $L$  all circles intersected by  $R_m$   
     $m \leftarrow m + 1$   
**end while** **return**  $m$ 

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- (b)

## Problem 3