

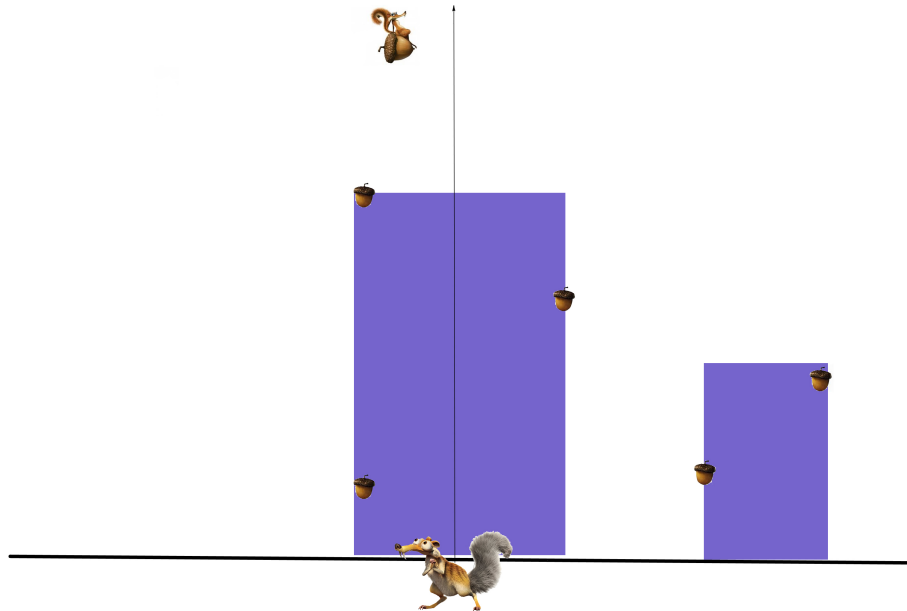
# Algorithm Design and Complexity

## First Assignment

November 19, 2012

### 1 Problem 1 - Ice Age

In his search for acorns, Scrat gets isolated on a tropical island, that has a long square beach. Let's assume that the shore is an X axis and that Scrat is at  $(0,0)$ . Scrat notices that there are  $N$  acorns on the beach, but it (the beach) belongs to Scratte so he cannot take the acorns. Scratte agrees to sell rectangles from the beach, each having a surface of maximum  $M$  units. Each rectangle must have its sides parallel to  $Ox$  and  $Oy$ , and one on  $Ox$ , like in the image below. However, for each area Scratte asks Scrat to perform a very dangerous task. Help Scrat buy as few rectangles as possible such that he gets all the acorns.



### 1.1 Input data

The input file (acorns.in) contains on the first row  $N$  and  $M$ , the number of acorns and the maximum area. The next  $N$  rows contain the coordinates of the  $N$  acorns. An example is below.

```
5 10
-1 1
1 3
-1 5
3 1
4 2
```

### 1.2 Output data

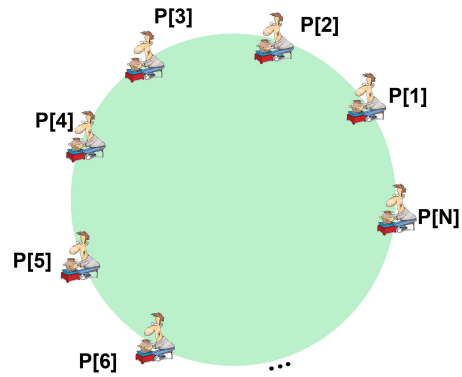
The output file (acorn.out) contains the minimum number of squares bought.(2 for the example above)

### 1.3 Restrictions

```
 $N \leq 200000$ 
 $1 < A \leq 10^8$ 
 $-10^9 \leq x \leq 10^9$ 
 $0 < y \leq A$ 
```

## 2 Problem 2 - The Potters

At the 2012 Potters' Convention, the organizers decide to make some sort of Potathon, a pot-making event in which all the potters create pots for one day. The  $N$  participants are placed on a circular stage, as seen below. The organizers know the productivity of each potter (the difference between how much it spends and the value of his pots). They collect pots  $K$  times during the event but each time they only choose a sequence of potters (adjacent potters on the circle) from whom the potts were not collected that day. Knowing each potter's productivity, help the organizers collect the potts such that the sum of the productivities from the selected potters is maximum.



## 2.1 Input data

The input file (potters.in) contains on the first row  $N$  and  $K$ , the number of potters and the number of collections. The next  $N$  rows contain the values of the productivities from each potter. An example is below.

```
10 3
4
10
-15
6
-7
-4
12
-10
5
-4
```

## 2.2 Output data

The output file (potters.out) contains the maximum sum of productivities. (33 for the example above)

## 2.3 Restrictions

$$1 < N \leq 1000$$

$$1 \leq K \leq 1000$$

$$-10^5 \leq P[i] \leq 10^5, \text{ where } P[i] \text{ is the productivity of potter } i$$

If the maximum sum is negative, the organizers prefer not to collect the pots