Homework 1

Mihai Codoban Arpit Christi Caius Brindescu

October 11, 2014

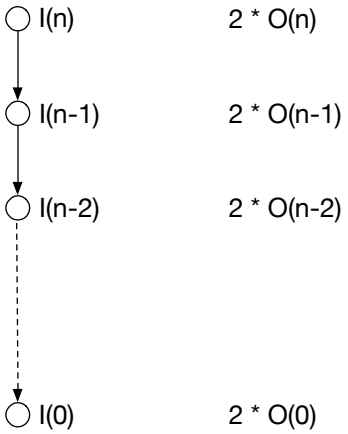
Problem 1

a) For the $O(n^2)$ solution we compute the intersection between one segment and the rest of the segments. Then we remove that segment and recursively compute the intersections between the rest of the segments.

Algorithm 1 $O(n^2)$ solution

```
function INTERSECTIONS(P[1..n] , Q[1..n])
    i ← FINDINTERSECTIONSWITHSEGMENT(P[1], Q[1..n])        ▷ O(n)
    REMOVEPOINTAT(i + 1, Q[1..n])                          ▷ O(n)
     return i + INTERSECTIONS(P[2..n],Q[1..n-1])
end function
function FINDINTERSECTIONSWITHSEGMENT(p , Q[1..n])
    i ← 0
    while Q[i] < p do
        i ← i + 1
    end while
     return i
end function
function REMOVEPOINT(i, Q[1..n])
    for j ← i, n − 1 do
        Q[i] ← Q[i + 1]
    end for
end function
```

Runtime analysis $I(n) =$ worst case runtime of function *intersections*
$I(n) = I(n-1) + 2 * O(n)$



$I(n) = \sum_{i=0}^{n} 2 * O(i) = 2 * \sum_{i=0}^{n} O(i) \Rightarrow 2 * O(n^2) \Rightarrow O(2 * n^2) \Rightarrow O(n^2)$

Problem 2

Problem 3

Problem 4