

CS 473: Algorithms, Spring 2011

HW 0 (due Monday, 23:59:59, January 24)

This homework contains two problems; problem 0 is composed of a number of small problems on campus. **Read the instructions for submitting homework on the course webpage.**

Note, that you have to submit your solution online (no paper submission).

Collaboration Policy: For this homework, each student should work independently and write up their own solutions and submit them.

Read the course policies before starting the homework.

0. (60pts) HW0 online on compass.
1. (40pts) A somewhat non-standard version of Euclid's algorithm for finding the greatest common divisor (gcd) of two non-negative integer numbers x and y is the following.

```
WeirdEuclid( $x, y$ ):  
    if  $y = 0$  then  
        return  $x$   
    if  $x = 0$  then  
        return  $y$   
    if  $x$  is even and  $y$  is even then  
        return  $2 * \text{WeirdEuclid}(x/2, y/2)$   
    if  $x$  is even and  $y$  is odd then  
        return WeirdEuclid( $x/2, y$ )  
    if  $x$  is odd and  $y$  is even then  
        return WeirdEuclid( $x, y/2$ )  
    if  $y > x$  then  
        return WeirdEuclid( $y - x, x$ )  
    else  
        return WeirdEuclid( $x - y, y$ )
```

Prove via induction that the algorithm correctly computes the gcd of x and y . Also prove that the running time of the algorithm is polynomial in the input size. Note that the input size is $\Theta(\log x + \log y)$. Assume that basic arithmetic operations take constant time.

Hint: Think about the binary representation of x and y .