BU CLA CS 530: Analysis of Algorithms

Spring 1996

Problem Set 5

Due Thursday 96.02.22, at 11:00 am, in class. Late submissions not accepted.

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1. Prove by induction that the following algorithm for the multiplication of natural numbers is correct:

   ```
   MULTIPLY(y, z)
       x ← 0
       while z > 0 do
           if z mod 2 = 1 then x ← x + y
           y ← 2 · y
           z ← ⌊z/2⌋
       return x
   ```

   Show the steps of your induction carefully. *Hint*: An appropriate invariant for the induction is $y_j z_j + x_j = y_0 z_0$, where x_j, y_j, and z_j denote the values in x, y, and z immediately after the jth iteration of the **while**-loop. y_0 and z_0 are the values in y and z immediately before the first iteration.

2. (a) Exercise 7 in Handout 2.

   (b) Exercise 9 in Handout 2.

   Hint: It may help you to ponder Exercises 6 and 8 in Handout 2.

3. Exercise 26.2-5, page 565, in [CLR].

4. Problem 26-1, page 576, in [CLR].

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