CSC 421/Applied Algorithms and Structures  
Problem set 3

Name: Kavana Manvi Krishnamurthy

Depaul ID: 2158984

Exercises

*Exercise GCD (8 points)*

Using the fast Euclid GCD algorithm given in exercise 25(c) of the textbook, fill out a table showing the steps the algorithm goes through to find the GCD of two natural numbers. For example, to find the GCD of 119 and 35, the table would be:

|  |  |  |
| --- | --- | --- |
| **a** | **b** | **a mod b** |
| 119 | 35 | 14 |
| 35 | 14 | 7 |
| 14 | 7 | 0 |
| **7** | 0 |  |

The GCD of 119 and 35 is 7, as highlighted in red. In your tables, indicate in some way (bold-face,

different color, circled) the GCD. Please do this for the pairs:

a)  36, 14

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **A MOD B** |
| 36 | 14 | 8 |
| 14 | 8 | 6 |
| 8 | 6 | 2 |
| 6 | 2 | 0 |
| **2** | 0 |  |

b)  111, 11

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **A MOD B** |
| 111 | 11 | 1 |
| 11 | 1 | 0 |
| **1** | 0 |  |

c)  4415, 1642

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **A MOD B** |
| 4415 | 1642 | 1131 |
| 1642 | 1131 | 511 |
| 1131 | 511 | 109 |
| 511 | 109 | 75 |
| 109 | 75 | 34 |
| 75 | 34 | 7 |
| 34 | 7 | 6 |
| 7 | 6 | 1 |
| 6 | 1 | 0 |
| **1** | 0 |  |

d)  12345, 135

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **A MOD B** |
| 12345 | 135 | 60 |
| 135 | 60 | 15 |
| 60 | 15 | 0 |
| **15** | 0 |  |

*Exercise* BUBBLESORT *(7 Points)*

a)  Write down the double summation that counts how often the comparison in the if statement is performed.

The double summation that counts how often the comparison in the if statement is:

b)  Find the closed form of that double summation.

The double summation that counts how often the comparison in the if statement is:

Let’s solve the first summation:

Let’s solve the entire equation by substituting in the first equation :

c)  Write down the asymptotic formula (that is, using big-Oh notation) derived from that

closed form.

Based on the answer from the last question, big-Oh notation is:

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