Homework 1 of Computer Algorithms 2009

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March 10, 2009

Deadline: March 31, 2009

1. Implement 'Quick Sort' and 'Bubble Sort' in Java.

    (a) Run the two on randomly generated ten numbers
    (b) Run the two on randomly generated 10,000 numbers
    (c) Run the two on ten sorted numbers
    (d) Run the two on 10,000 sorted numbers

2. Calculate $\Theta(n)$ of the following code fragments.

    (a)
    ```
    for(int i = 0; i < n; i++)
        sum++;
    ```
    (b)
    ```
    for(int i = 0; i < n; i+=2)
        sum++;
    ```
    (c)
    ```
    for(int i = 0; i < n; i++)
        for( int j = 0; j < n; j++)
            sum++;
    ```
    (d)
    ```
    for(int i = 0; i < n; i+=2)
        sum++;
    for(int j = 0; j < n; j++)
        sum++;
    ```
    (e)
    ```
    for(int i = 0; i < n; i++)
        for( int j = 0; j < n * n; j++)
            sum++;
    ```
    (f)
    ```
    for(int i = 0; i < n; i++)
        for( int j = 0; j < i; j++)
            sum++;
    ```
    (g)
    ```
    for(int i = 0; i < n; i++)
        for( int j = 0; j < n * n; j++)
            for(int k = 0; k < j; k++)
                sum++;
    ```
    (h)
    ```
    for(int i = 1; i < n; i = i * 2)
        sum++;
    ```

3. Solve $a_n = 4a_{n-1} - 4a_{n-2}$, for $n \geq 2$ with $a_0 = a_1 = 1$ using the characteristic equation method.

   (a) Solve $a_n = 2a_{n-1} + 3^n$, for $n \geq 1$ with $a_0 = 2$ using the characteristic equation method.

   (b) Solve $a_n = 2a_{n-1} - a_{n-2} + 5^n$, for $n \geq 2$ with $a_0 = a_1 = 1$ using the characteristic equation method.

   (c) Solve $a_n = 3a_{n-1} - 4n$, for $n \geq 1$ with $a_0 = 2$ using the characteristic equation method.

   (d) Solve the recurrence relation for 'Tower of Hanoi'.

   (e) Solve $a_n = 4a_{n-1} - 4a_{n-2} + 2^n + 1$, for $n \geq 2$ with $a_0 = a_1 = 1$ using the characteristic equation method.

4. Describe "Cargo Cult Science" in 100 words.

   (a) Is Hwang Woo-Suk's case a cargo cult science?
       (`http://en.wikipedia.org/wiki/Hwang_Woo-Suk`)