SEGR 503 Data Structures and Algorithms
Assignments #2

Problems (all the problems could be found in the textbook. 26 points)

• Exercises 2.3 (4 points)
Excerpt from 6:

Consider the following algorithm.

Algorithm Enigma(A[0..n - 1, 0..n - 1])
//Input: A matrix A[0..n - 1, 0..n - 1] of real numbers
for i ← 0 to n - 2 do
    for j ← i + 1 to n - 1 do
        if A[i, j] ≠ A[j, i]
            return false
    return true

Question: what is efficiency class of this algorithm?

• Exercises 2.4 (4 points)

3. Consider the following recursive algorithm for computing the sum of the first n cubes:
   S(n) = 1³ + 2³ + ... + n³.

Algorithm S(n)
//Input: A positive integer n
//Output: The sum of the first n cubes
if n = 1 return 1
else return S(n - 1) + n * n * n

   a. Set up and solve a recurrence relation for the number of times the algorithm’s basic operation is executed.

   b. How does this algorithm compare with the straightforward nonrecursive algorithm for computing this function?

• Exercises 3.1 (6 points)

4. a. Design a brute-force algorithm for computing the value of a polynomial
   p(x) = a_nx^n + a_{n-1}x^{n-1} + ... + a_1x + a_0
   at a given point x_0 and determine its worst-case efficiency class.
b. If the algorithm you designed is in $\Theta(n^2)$, design a linear algorithm for this problem.

- **Exercises 3.1 (4 points)**
  8. Sort the list $E, X, A, M, P, L, E$ in alphabetical order by bubble sort. Please show the middle steps to the sorted list.

- **Exercises 3.2 (4 points)**
  9. Consider the problem of counting, in a given text, the number of substrings that start with an A and end with a B. (For example, there are four such substrings in CABAAXBYA.)
  (a) Design a brute-force algorithm for this problem and determine its efficiency class.

- **Exercises 3.4 (4 points)**
  8. Explain how exhaustive search can be applied to the sorting problem and determine the efficiency class of such an algorithm.

**Submission**

- Deadline: Monday, 1/24/2010, 6:00PM
- For those exercises that require algorithm design, ideally you should use C++ or Java programming languages. At least, you should use pseudo codes like those in the textbook and lecture slides in order to receive full score.
- Email your solutions to zhuy@seattleu.edu. Only PDF and text formats are accepted!