Problems (all the problems could be found in the textbook. 22 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? Please follow the procedure we’ve done in class to derive its time efficiency.

- Exercises 2.4 (4 points)

  3. Consider the following recursive algorithm for computing the sum of the first n cubes:

    S(n) = 1^3 + 2^3 + ... + n^3.

  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_n x^n + a_{n-1} x^{n-1} + ... + a_1 x + 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 in this sorting.

- 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 CABAAAXBYA.)
    (a) Design a brute-force algorithm for this problem and determine its efficiency class.

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!