CS 3520: Algorithms

Homework 1

**Due Date: Wednesday, February 8, 2017 at beginning of class**

Type your answers in a word processor, print and submit hardcopy in class.

Show your steps to receive partial credit.

1. (20 points) What is an algorithm? What are the steps in algorithm design and analysis?
2. (20 points) For each of the following functions, indicate the class Θ (*g*(*n*)) the function belongs to. Use the simplest *g*(*n*) possible in your answers.

a.

b.

c.

d.+

1. (20 points) Consider the following algorithm where the input A[0..*n* − 1]) is an array of *n* integers.

**ALGORITHM** ALG1(A[0..*n* − 1])

**for** *i* ←0 **to** *n − 2* **do**

**for** *j* ←0 **to** *n − 2 − i* **do**

**if** A[*j* + 1]<A[*j*] swap A[*j*] and A[*j*+1]

a. What does this algorithm do?

b. What are the basic operations of this algorithm?

c. How many times are the basic operations executed?

d. What is the efficiency class of this algorithm? Express your answer with the most appropriate O, Θ or Ω notation.

1. (20 points) Solve the following recurrence relations and find an explicit formula for .

a. for

b. for

c. for

d. for

1. (20 points) Consider the following recursive algorithm where the input A[0..*n* − 1]) is an array of *n* real numbers.

**ALGORITHM** *R*(*A[0..n − 1]*)

**if** *n = 1* **return** *A[0]*

**else** *temp←R(A[0..n − 2])*

**if** *temp* *≥* *A[n − 1]* **return** *temp*

**else** **return** *A[n − 1]*

a. What does this algorithm compute?

b. What is its basic operation of this algorithm?

c. Set up a recurrence relation for the algorithm’s basic operation count and solve it.