CMSC 341 Data Structure

Asymptotic Analysis Review

These questions will help test your understanding of the asymptotic analysis material discussed in class and in the text. These questions are only a study guide. Questions found here may be on your exam, although perhaps in a different format. Questions NOT found here may also be on your exam.

1. What is the purpose of asymptotic analysis?
2. Define “Big-Oh” using a formal, mathematical definition.
3. Let *T*1(*x*) = *O*(*f*(*x*)) and *T*2(*x*) = *O*(*g*(*x*)). Prove *T*1(*x*) + *T*2(*x*) = *O* (max(*f*(*x*), *g*(*x*))).
4. Let *T*(*x*) = *O*(*cf*(*x*)), where *c* is some positive constant. Prove *T*(*x*) = *O*(*f*(*x*)).
5. Let *T*1(*x*) = *O*(*f*(*x*)) and *T*2(*x*) = *O*(*g*(*x*)). Prove *T*1(*x*) \* *T*2(*x*) = *O*(*f*(*x*) \* *g*(*x*))
6. Prove 2n+1 = *O*(2n).
7. Prove that if *T*(*n*) is a polynomial of degree *x*, then *T*(*n*) = *O*(*nx*).
8. Number these functions in ascending (slowest growing to fastest growing) Big-Oh order:

|  |  |
| --- | --- |
| **Number** | **Big-Oh** |
|  | *O*(*n*3) |
|  | *O*(*n*2 lg *n*) |
|  | *O*(1) |
|  | *O*(lg0.1 *n*) |
|  | *O*(*n*1.01) |
|  | *O*(*n*2.01) |
|  | *O*(2*n*) |
|  | *O*(lg *n*) |
|  | *O*(*n*) |
|  | *O*(*n* lg *n*) |
|  | *O* (*n* lg5 *n*) |

1. Determine, for the typical algorithms that you use to perform calculations by hand, the running time to:
   1. Add two N-digit numbers
   2. Multiply two N-digit numbers
2. What is the asymptotic performance of each of the following?

Select among:

a*. O*(*n*) b. *O*(*n*2) c. *O*(*n* lg *n*) d. *O*(*n*3) e. *O*(lg *n*)

f. *O*(1) g. *O*(*n*!) h. None of these

1. \_\_\_\_\_\_\_\_\_\_\_ Squaring each element of an NxN matrix
2. \_\_\_\_\_\_\_\_\_\_\_ Finding the smallest value in a sorted array of N integers
3. \_\_\_\_\_\_\_\_\_\_\_ Finding a value in a sorted array using binary search
4. \_\_\_\_\_\_\_\_\_\_\_ Pushing N elements onto a stack, then popping them and printing them
5. \_\_\_\_\_\_\_\_\_\_\_ Finding the largest 3 values in an unsorted array
6. What is the asymptotic performance of the following Java code fragment?

Justify your answer.

for (int i = 0; i < N; i++)

{

for (int j = 10; j >= 0; j--)

{

int count = 1;

while (count < N)

count \*= 2;

}

}