CS210 Data Structures and Algorithms Spring 2024

Assignment #2

TOTAL POINTS: 25

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1. What is the tightest bound Big O for the following: (10 Points)

   a) $f(N) = (1/2)\ (N \log N) + (\log N)^2$ _____O(NLogN)_____

   b) $f(N) = N^2 * (N + N \log N + 1000)$ _____O(N^2)_____

   c) $f(N) = N^2 \log N + 2^N$ _____O(2^n)_____

   d) $f(N) = (\ (1/2)\ (3N + 5 + N)\ )^4$ _____O(N^4)_____

   e) $f(N) = (2N + 5 + N^4\ ) / N$ _____O(N^3)_____

   f) $f(N) = \log_{10}(2^N\ )$ _____O(N)_____

   g) $f(N) = N! + 2N$ _____O(N!)_____

   h) $f(N) = (N * N * N * N + 2N)^2$ _____O(N^8)_____

   i) $f(N) = N^{½} + \log N$ _____O(N^(1/2))_____

   j) $f(N) = N \log (100^3\ )$ _____O(N)_____

2. Give the tightest bound in terms of Big O, of the following code snippets (6 points)

a. Answer: O(LogN)

```
public type something(n){
        result = 0;
        while (n > 1){
             n /= 2;
             result += 1;
        }
        return result;
   }
```

b. Answer: O(N)

```
public type something (n, a[]){
        for (i=0, i<n; i++){
             if (a[i] == 0)
                  return 0;
        }
        return 1;
   }
```

c. Answer: O(N^2)

```
public type something(n){
        result = 0;
        for (i=0, i<n; i++){
             for (int j=i; j<n;j++){
                  result += 1;
             }
        }
        return result;
   }
```

For the following questions answer True / False (4 Points)

3. In Asymptotic Analysis, the exact running time is calculated.

TRUE FALSE

4. For analyzing an algorithm, we study how the running time of the algorithm increases with the increase in input size.

TRUE FALSE

5. Growth rate of n is more than growth rate of log n

TRUE FALSE

6. F(n) = 5n+3. This function is O(n!)

TRUE FALSE

Multiple Choice Questions (5 Points)

7. Arrange the following in increasing order of asymptotic complexity

F1(n) = n^2 +10n

F2(n) = log n +89

F3(n) = nlog n + 2^n

a. F1, f2, f3	b. F2, f1, f3
c. F2, f3, f1	

8. What is the runtime efficiency of the following code

For (i=0; i<n-3; i++)

a[i] = 0

a. O(n)	b. O(n^2)
c. O (log n)	d. O (1)

9. Which assumption is not required for the RAM model of computation?

a. unit time per datum storage or retrieval	b. infinite memory
c. unit time per mathematical operation	d. presorted data

10. Why are data structures important for the implementation of algorithms?

a. They influence the speed at which data can be stored and retrieved.	b. They allow you to set termination criteria.
c. They enable sorting methods.	d. They limit the size and type of data that can be stored.

11. Why is the following instruction not an algorithm?

If you see a bear, run.

a. It does not say which way to run.	b. It does not specify the kind of bear.
c. Neither the problem nor the solution steps are precisely defined.	d. There is no looping or repeat instruction.