Bahria University

Karachi Campus



COURSE: DATA STRUCTURES AND ALGORITHMS

TERM: SPRING 2020, CLASS: BCE- 4(A)

Submitted By:

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Assignment: 01

Submitted To:

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Signed Remarks: Score\_\_\_\_\_\_\_\_

**Question no 1:**

**List down the best, worst, average time complexity of all the data structures.**

**Answer:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Data Structures** | **Best Time Complexity** | **Average Time Complexity** | **Worst Time Complexity** |
| Quick Sort | Ω(nlog(n)) | Ɵ(nlog(n)) | O) |
| Merge Sort | Ω(nlog(n)) | Ɵ(nlog(n)) | O(nlog(n)) |
| Tim Sort | Ω(n) | Ɵ(nlog(n)) | O(nlog(n)) |
| Heap Sort | Ω(nlog(n)) | Ɵ(nlog(n)) | O(nlog(n)) |
| Bubble Sort | Ω(n) | Ɵ() | O) |
| Insertion Sort | Ω(n) | Ɵ() | O) |
| Selection Sort | Ω() | Ɵ() | O) |
| Tree Sort | Ω(nlog(n)) | Ɵ(nlog(n)) | O) |
| Bucket Sort | Ω(n+k) | Ɵ(n+k) | O) |
| Radix Sort | Ω(nk) | Ɵ(nk) | O(nk) |
| Shell Sort | Ω(nlog(n)) | Ɵ(log) | O(nlog) |
| Counting Sort | Ω(n+k) | Ɵ(n+k) | O(n+k) |
| Cube Sort | Ω(n) | Ɵ(nlog(n)) | O(log(n)) |
| Stack | N/A | Ɵ(n) | O(n) |
| Queue | N/A | Ɵ(n) | O(n) |
| Single linked list | N/A | Ɵ(n) | O(n) |
| Double linked list | N/A | Ɵ(n) | O(n) |
| B-Tree | N/A | Ɵ(log(n)) | O(log(n)) |
| Binary Search Tree | N/A | Ɵ(log(n)) | O(n) |
| AVL Tree | N/A | Ɵ(log(n)) | O(log(n)) |
| KD Tree | N/A | Ɵ(log(n)) | O(n) |
| Splay Tree | N/A | Ɵ(log(n)) | O(log(n)) |
| Red-Black Tree | N/A | Ɵ(log(n)) | O(log(n)) |
| Cartesian Tree  Hash Table | N/A  N/A | Ɵ(log(n))  Ɵ(1) | O(n)  O(n) |
| Skip List | N/A | Ɵ(log(n)) | O(n) |
| Array | N/A | Ɵ(n) | O(n) |

**Question no 2:**

**Define an algorithm to reverse the string using an array.**

**Answer:**

**Algorithm to reverse a String:**

1. Initialize or declare a string.
2. Define its length using length() function.
3. Repeat for string.length()-1 to 0

[End of loop].

1. Exit.

**Question no 3:**

**Define an algorithm that prints out all the subset of four elements of a set of n elements the elements of this set are sorted in a list that is input to the algorithm.**

**Answer:**

**Algorithm to print all the subsets of four elements:**

1. Initialize an array of 4 (n) elements.
2. Repeat until all the elements are taken from the user

[End of 1st loop].

1. Run three loops (nested loop) for the output of subsets as there are four elements so one will be removed at a time.
2. Repeat for i=0 to n-2 (for first element).
3. Repeat for j=i+1to n-1 (for 2nd element).
4. Repeat for k=j+1 to n (for 3rd element)
5. Print all the three elements

[End of 2nd, 3rd and 4th loops]

1. Exit.

**Question no 4:**

**A positive integer is input, Define a function (function name: binary) to find the binary equivalent of this number using recursion. For example, if input is 156, then binary value is 10011100 (no code is needed, just a sketch and pseudo code).**

**Answer:**

**Sketch:**

Sketch the binary equivalent of 156 (Convert decimal into binary).

Decimal Number

Binary Conversion

Remainder

2 156 0

2 78 0

2 39 0

2 19 1 =

2 9 1

2 4 1

2 2 0

2 1 0

**Pseudo Code:**

1. Construct a function named binary and initialize a variable ‘rem’ (remainder) and declare ‘binarynum’ 0 and ‘temp’ 1.
2. Repeat while ‘decimalnum’ is not equal to 0.
3. Implement the following formulas until the condition is valid:

rem=decimalnum%2

decimalnum=decimalnum/2

binarynum=binarynum+rem\*temp

temp=temp\*10

[End of loop].

1. Return binarynum.
2. In main() function, initialize ‘decimalnum’ and take it from user.
3. Call the binary() function.
4. Exit.