Code : 100304

B.Tech 3rd Semester Exam., 2020
(New Course)

DATA STRUCTURES AND ALGORITHMS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) Which of the following is time complexity of the given code?

```
int a = 0;
for (i = 0; i<N; i ++) {
    for (j = N; j>i; j--) {
        a = a + i + j;
    }
}
```

(i) O(N)

(ii) O(N*log(N))

(iii) O(N*Sqrt(N))

(iv) O(N*N)

(b) Which of the following is time complexity of the given code?

```
int i, j, k = 0;
for (i = n/2; i<= n; i ++) {
    for (j = 2; j<= n; j = j*2) {
        k = k + n/2;
    }
}
```

(i) O(N)

(ii) O(N*log(N))

(iii) O(N*Sqrt(N))

(iv) O(N*N)

(c) Which of the following cases does not exist in complexity theory?

(i) Best case

(ii) Worst case

(iii) Average case

(iv) Null case

(d) The operation of processing each element in the list is known as

(i) sorting

(ii) merging

(iii) inserting

(iv) traversal

(e) Arrays are best data structures

(i) for relatively permanent collections of data

(ii) for the size of the structure and the data in the structure are constantly changing

(iii) Both (i) and (ii)

(iv) None of the above

(f) Each array declaration needs not give, implicitly or explicitly the information about

(i) the name of array

(ii) the data type of array

(iii) the first data from the set to be stored

(iv) the index set of the array

(g) In general, the binary search method needs not more than _____ comparisons.

(i) $[\log_2 n] - 1$

(ii) $[\log n] + 1$

(iii) $[\log_2 n]$

(iv) $[\log_2 n] + 1$

(h) State True or False :

A. Binary search is used for searching in a sorted array.

B. The time complexity of binary search is $O(\log n)$.

(i) True, False

(ii) False, True

(iii) False, False

(iv) True, True

(i) Which of the following is non-linear data structure?

(i) Stack

(ii) Linked list

(iii) String

(iv) Tree

(j) Which is the correct output for the following sequence of operations?

push(5)
push(8)
pop
push(2)
push(5)
pop
pop
pop
push(1)
pop

(i) 8 5 2 5 1

(ii) 8 5 5 2 1

(iii) 8 2 5 5 1

(iv) 8 1 2 5 5

2. Analyse the time complexity of the given function and also write the recurrence relation of the function : 14

```
int DoSomething (int n)
{
if (n<= 2)
  return 1;
else
 return (DoSomething (floor(sqrt(n)))+n);
 }
```


3. Consider the following postfix expression :

8 7 3 -/ 6 2 5 4 + * + -

The above expression is evaluated using stack. Show the content of stack after each step. 14

4. What are the different notations for comparing the time complexity of an algorithm? Explain each of them with neat figures. 14

5. Explain the queue and circular queue with examples. Also, write the differences between the two. 14

6. Let a and b be positive integers. Suppose a function F is defined recursively as follows :

$$F(a, b) = \begin{cases} 0 & \text{if } a < b \\ F(a-b, b)+1 & \text{if } b \le a \end{cases}$$

Find the values of the following : 7×2=14

(a) $F(2, 3)$

(b) $F(14, 3)$

7. (a) Write the algorithm of prefix evaluation with example. 7

(b) Write prefix notation of the following infix notation : 7

$A+B*C+D$

8. What do you mean by ADT? Explain the ADT stack with test cases for both pop and push. 14

9. Write short notes on the following : 3½×4=14

   (a) Hashing

   (b) Circular linked list

   (c) Adjacency list

   (d) AVL tree

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