Programme: B Tech Computer Science

Course Name & code: BCSE202L Data Structures and Algorithms

Class Number (s): VL2022230506314, 5850, 5853, 5856, 5839, 5843, 5858, 5841, 6333, 5848

Faculty Name (s): S M Farooq, Ganesh S K, Keerthika P, Sayan S, Jafar Ali Ibrahim, Sunil Kumar, Lakshmanan K, Kalaivani K, Priyanka N, Thurai Pandian M,

Exam Duration: 90 Min. Maximum Marks: 50

General instruction(s):

Answer all questions.

| Q.No. | Question | Max Marks |
|---|---|---|
| 1. | Generate polynomial functions for the following three code segments and compute the time complexity. (3+3+4) | 10 |

Segment-1

```
test1()
{
  int j = 0, k = 2;
  while(j > 0)
  {
     j += k;
     k *= 2;
   }
}
```

Segment-2

```
int test2(int n)
{
   int k = 0;
   for (int x = 0; x < n; x++)
       for (int y = n; y > x; y--)
          k +=  x + y;
   return (k);
}
```

**Segment-3**

```
int test3(int n)
{
    int x, y, z = 0;
    for (x = n/2; x <= n; x++)
        for (y=2; y<=n; y *= 2)
            z += n/2;

    return (z);
}
```

| | | |
|---|---|---|
| 2. | a) Solve the following recurrence using recurrence tree method (5)<br>$T(n) = T(n/5) + T(4n/5) + n$<br><br>b) Solve the following recurrences using Master's method (2+3)<br>i) $T(n) = 2T(n-1) + n$<br>ii) $T(n) = 4T\left(\frac{n}{2}\right) + n^3/\log^2 n$ | 10 |
| 3. | a) In a stack, four numbers 1, 2, 3, 4 can be pushed or popped in any random order. Each number can be pushed or popped multiple times. Popping a number prints it. The sequence of operations performed on the stack is Push → Push → Pop → Push → Pop → Pop → Push → Pop → Push. This sequence printed the numbers 1, 1, 3, 2 in that order. Which number was pushed first? Justify your answer. (5)<br><br>b) Discuss the limitation of a linear queue. Illustrate how this is overcome in circular queue with the help of a suitable example. (5) | 10 |
| 4. | Convert $(A/B) \wedge C + ((D + E) * F \wedge C)$ to postfix and then evaluate the expression for $A = 18$, $B = 3, C = 2$, $D = 13$, $E = 7$, and $F = 5$ using an appropriate data structure. The processing of each symbol and status of the data structure at each step is expected in both conversion and evaluation. | 10 |
| 5. | a) Can you improve the best-case complexity of bubble sort by optimizing the traditional algorithm? If yes, write the modified version of the algorithm and demonstrate how the improvement is achieved. (5)<br><br>b) Imagine we have two sorted lists with no common elements. Suppose we need to search for an element to see whether it is present in either of the lists. Write an efficient algorithm for this and analyze the time complexity of your algorithm (5) | 10 |

$C \wedge (DE$

$4 \cdot \frac{n}{5} * \frac{4n}{5}$

$T$

$\frac{4}{5}\left(\frac{4n}{5}\right)$

$n - 1 = \frac{n}{b}$

$bn - b = bn$

$b(n-1) = n$

$b = \frac{n}{n-1}$

$n^k = a$

$k \log n = \log a$

$(/AB) \wedge C + ((+DE)$

$/AB = T_1 ; +DE = T_2$

$\Rightarrow (T_1 \wedge C) + ((T_2 * F)$

$\Rightarrow (\wedge T_1 C) + ((* T_2 F)$

$\Rightarrow \wedge T_1 C + * T_3 C$