

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT  
TEST-2 EXAMINATION (APRIL 2019)

B-Tech (2<sup>nd</sup> SEM)

Course Code: 18B11CI211

Max. Marks: 25

Course Name: DATA STRUCTURES AND ALGORITHMS

Max. Time: 1.5 HRS

Course Credit: 4

**Note: All questions are compulsory. Skip syntax error (if there any).**

**Section – A (5x1 = 5 marks)**

**Q1.**

- If the characters 'D', 'C', 'B', 'A' are placed in a queue (in that order), and then removed one at a time, in what order will they be removed?
- Justify the statement: “*The order of increment/decrement of TOP pointer in Push/Pop operation of Stack is matter of concern*”?
- The following postfix expression with single digit operands is evaluated using a stack:

$$8\ 2\ 3\ \wedge / 2\ 3\ * + 5\ 1\ * -$$

Find the top two elements of the stack after the first \* is evaluated.

- What do you mean by head-tail linked list?
- List the various applications of priority queue.

**Section – B (4x2 = 8 marks)**

- Q2.** Let  $S$  represent an instance of the Stack ADT. Let  $S.push(x)$  push the value  $x$  on to the top of the stack,  $S.pop()$  remove the topmost element from the stack and return the value. Consider the following sequence of operations performed on  $S$  which initially contains 10 elements with 55 as the top most element (Assume that  $S$  is of sufficient capacity).

$S.push(7); S.push(20); S.push(35); S.pop(); S.push(14); S.pop(); S.pop();$

What will be the element at the top of the stack after the above sequence of operations? Show all the steps for your calculation.

- Q3.** The seven elements A, B, C, D, E, F and G are pushed onto a stack in reverse order, i.e., starting from G. The stack is popped five times and each element is inserted into a queue. Two elements are deleted from the queue and pushed back onto the stack. Now, one element is popped from the stack. Find the value of popped item and show all your computation steps.

**Q4.** Let **Q** be an instance of a Queue ADT. **Q.enqueue(x)** adds an element *x* to the queue. **Q.dequeue()** performs a dequeue operation on the queue and returns the value that gets dequeued. Consider the following **Code1** segment and find the value of the variable *count*, when the given segment of code completes its execution? Show all the steps for your calculation.

```
//Code1
Q.enqueue(1);
int count=1;
do {
    count=count+1;
    x = Q.dequeue();
    Q.enqueue( 2*x );
    Q.enqueue( 4*x );
} while(x!=32);
```

**Q5.** Algorithms **A** and **B** spend exactly  $T_A(n) = 0.1n^2 \log_{10} n$  and  $T_B(n) = 2.5n^2$  microseconds, respectively, for a problem of size *n*. Choose the algorithm, which is better in the Big-Oh sense, and find out a problem size  $n_0$  such that for any larger size  $n > n_0$  the chosen algorithm outperforms the other. If your problems are of the size  $n \leq 10^9$ , which algorithm will you recommend to use? Show all the steps for your calculation.

**Section – C (4x3 = 12 marks)**

**Q6.** What are the advantages of circular queue over a linear queue? Write an algorithm to perform insertion and deletion in circular queue.

**Q7.** Given a singly linked list, write a function to find the last element from the beginning whose  $n \% k = 0$ , where *n* is the number of elements in the list and *k* is an integer constant. For example, if  $n = 19$  and  $k = 3$  then we should return 18<sup>th</sup> node.

**Q8.** Convert the following given Infix expression into Postfix expression by using stack conversion method. Also find the maximum height of stack achieved during conversion.

$$(a * b - (c + d / e ^ f) - g) * h$$

**Q9.** Given an array of characters formed with a's and b's. The string is marked with special character X which represents the middle of the list (for example: ababa...ababXbabab baaa). By using stack write an algorithm to check whether the string is palindrome.