# B. Sc. ▮▮▮▮▮▮▮▮▮▮ Examination, 2023

( 2nd Year, 1st Semester )

## Computer Science II

### Paper – GE 3

Time : 1 hour                                   Full Marks : 20

Theoretical (20 marks)

(Symbols have usual meanings, if not mentioned otherwise)

**Part – I (10 Marks)**

Answer *any two* questions.

1. What is stack? How is it represented in computer memory? Write down two main functions for insertion and deletion in a stack.                    5

2. What is linked list? Write an algorithm to traverse a linked list considering that the linked list is stored in memory.                    5

3. Define binary tree. "There are three standard ways of traversing a binary tree T with root R." Mention the ways and write the algorithms.                    5

4. Describe the queue where the following operations take place.                    5

   a) F is added to the queue

   b) 2 letters are deleted

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c) K, L, and M are added to the queue

d) 2 letters are deleted

e) R is added to the queue

f) 2 letters are deleted

g) S is added to the queue

h) 2 letters are deleted

i) One letter is deleted

j) One letter is deleted

### Part – II (10 Marks)

Attempt **Q.1** and any **one** from the rest.

1. a) Prove that $f(n) = \Theta(g(n))$ if and only if $f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$.

   b) If $f(n)$ is a polynomial in $n$ of degree $k$, then show that $f(n) = \Theta(n^k)$.      2+2=4

2. Write the Merge-sort algorithm to sort an array of integers and explain different steps in the light of divide-and-conquer paradigm of algorithm.      3+3=6

3. a) What are the minimum and maximum numbers of elements in a heap of height $h$?

   b) Let a heap be implemented by an array with length equal to the heap size. Is the array with values 23, 17, 14, 6, 13, 10, 1, 5, 7, 12 a max-heap?      3+3=6

4. Use induction to prove that radix sort works. Where does you proof need the assumption that the intermediate sort is stable?      4+2=6