

**2021**

**COMPUTER SCIENCE — HONOURS**

**Fourth Paper**

**(Group - A)**

**Full Marks : 50**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

Answer **question no. 1** and **any three** questions from the rest,  
taking at least **one** from each **Section**.

1. Answer **any four** questions :

2×4

- (a) What is the depth of a complete binary tree with  $n$  nodes?
- (b) State an advantage of a circular linked list over a linear linked list.
- (c) What is the functionality of `scanf ()`?
- (d) Differentiate between `malloc ()` and `calloc ()` function in C.
- (e) Differentiate between structure and union.
- (f) Distinguish between linear and non-linear data structures.
- (g) What is linear probing in hashing?
- (h) List the differences between `putchar ()` and `putch ()`.

**Section-I**

**(Data Structure - II)**

2. (a) Write an algorithm for searching a given element in a binary search tree. If the element is not present, your algorithm should insert it in the tree so that it remains binary search tree.
- (b) What is a heap? How can a heap be represented using an array?
- (c) Prove that if  $T$  is an extended binary tree with  $n$  internal nodes;  $I$ , its internal path length and  $E$ , its external path length then  $E = I + 2n$ ,  $n \geq 1$ . 5+(2+2)+5
3. (a) What are the criteria for choosing a good hash function?
- (b) Explain the following hash functions :
- (i) Division Method
  - (ii) Midsquare Method
  - (iii) Folding Method.

**Please Turn Over**

(c) Discuss the drawbacks of hashing.

(d) Form a binary search tree using following numbers :

15, 10, 5, 7, 6, 8, 19, 25, 23, 18

2+6+3+3

4. (a) Show that the average case time complexity of Quick sort is  $O(n \log_2 n)$ .

(b) Write an algorithm to sort a list of elements using merge-sort technique.

(c) Write a non-recursive algorithm to traverse a binary tree using inorder traversal.

4+5+5

### Section-II

#### (Programming through C Language)

5. (a) Describe the bitwise operators with suitable examples.

(b) What would be printed from the following program segment?

```
char c[] = 'computer', *p;
int i;
for (p = &c[5]; p >= &c[0]; p--)
    printf ("%c", *p);
printf ("\n");
for (p = c + 5, i = 0; p >= c; p--, i++)
    printf ("%c", *(p - i));
```

(c) Differentiate `sprintf()` and `printf()` with example.

(d) Write a C program to find the smallest of 3 numbers using ternary operator only.

4+4+4+2

6. (a) Explain “call by value” and “call by reference” mechanisms for function calls with appropriate examples.

(b) What is expected to happen when the following code in C is executed on two given integers  $A$  and  $B$ ? Justify with a suitable example.

$$A = A \wedge B;$$

$$B = A \wedge B;$$

$$A = A \wedge B;$$

(c) Write a program using C language to compute the roots of a quadratic equation  $ax^2 + bx + c = 0$ , given the values of  $a$ ,  $b$  and  $c$ .

4+4+6

7. (a) Write a recursive function that returns the greatest common divisor of its two positive integer arguments.

(b) What is the meaning of `#include <stdio.h>` and why is this required in a C program?

(3)

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(c) Write the output of the following program

```
#include <stdio.h>
#define Multiply (a,b) a*b
void main ()
{
    int a=5, b=3;
    printf ("%d", Multiply (a+b, a-b));
}
```

(d) Evaluate  $(3 < 4) ? (5 < 6) ? 1 : 2 : (10 > 8) ? 3 : 4$

5+3+3+3

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