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.

(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?

(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