

2015
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* more questions taking at least *one* from each *Section*

1. Answer *any four* questions : 2×4
- (a) Define a heap.
 - (b) What is the total number of binary trees possible with 5 nodes ?
 - (c) What is linear probing in hashing ?
 - (d) What is internal sorting and external sorting ?
 - (e) Define storage class in C.
 - (f) What do you mean by the following declaration ?
`int(*p[10])(char a);`
 - (g) How a Structure is different from Union ?
 - (h) What is file pointer ?

Section – I

(Data Structures – II)

2. (a) The preorder traversal sequence of a binary search tree is 30, 20, 10, 15, 25, 23, 39, 35, 42. Construct the binary search tree. Give the modified binary search tree after deleting the root from your constructed binary search tree.

(b) Prove that, in a binary tree of height h there are at most $2^{(h-1)}$ leaf nodes.

(c) Construct a max heap with the following array of elements :

18, 26, 10, 7, 16, 19, 23, 72, 37, 4, 33, 1, 5, 11, 21

Show with explanation, the different intermediate stages in the process of forming a heap. (4+1)+4+5

[Turn Over]

3. (a) What is an extended binary tree? For such a tree prove that, $E=I+2*q$, where q is the number of internal nodes, I denotes internal path length and E denotes external path length.

(b) Write an algorithm to count number of leaf nodes and number of non-leaf nodes in a binary tree.

(c) Show insertion of the elements {4371, 1323, 6173, 4199, 4344, 9679, 1989} in a hash table of size 10 where hash function $h(x) = x \text{ mod } 10$ and collision resolution technique is quadratic probing. (2+4)+4+4

4. (a) Consider an array of elements:

54, 33, 21, 75, 69, 50, 80, 29

Assume array index starts from 1. Explain how stack can be used to sort this array using non-recursive quick sort technique. Show all the steps clearly.

(b) Write an algorithm to sort a list of elements using radix sort technique. Using your algorithm sort the following set of elements:

231, 33, 87, 5, 6239, 98

Clearly show all the steps. 6+(4+4)

Section – II

(Programming through C language)

5. (a) What is recursion? Write a program in C to display an input line backwards by recursion.

(b) Is there any difference between a void pointer and a NULL pointer? Justify.

(c) Explain the usage of break and continue in C programs.

(d) Write a short note on static storage class. Give example. (1+3)+3+3+4

6. (a) Explain the concept of array of pointers with a suitable example.

(b) Consider the following structure declaration

```
struct complexnum
```

```
{
```

```
    int x;
```

```
    int y;
```

```
};
```

```
typedef struct complexnum complex;
```

Write three C functions called sum(), mult() and show() which adds, multiplies two complex numbers and displays the complex number in (x+iy) form respectively.

(c) Distinguish between macros and functions.

4+6+4

7. (a) Consider the following C program code:

```
#include<stdio.h>
int main(int argc,char*argv[])
{
    while (--argc)
        printf ("%s%c", *++argv, argc > ? " " : "\n");
return 0;
}
```

Suppose the above program name is echo and you have entered **good morning** as the command line arguments. Then what will be the output of this code after execution ? Explain your answer.

Assume the above code is modified slightly as shown below :

```
#include <stdio.h>
int main()
{
    int argc = 3;
    char*argv[] = {"echo", "good", "morning"};
    while (--argc)
        printf("%s%c", *++argv, argc > ? " " : "\n");
    return 0;
}
```

In this case, after program execution will the output be changed or not ? Justify your answer.

(b) Using bitwise operator write a C program to count the number of 0s in the binary representation of an integer.

(c) Explain the concept of self-referential structure with a suitable example.

(4+2)+4+4