

ASSIGNMENT BOOKLET

M.Sc. (Mathematics with Applications in Computer Science)
M.Sc.(MACS)

PROGRAMMING AND DATA STRUCTURES

(1st January, 2023 to 31st December, 2023)

- It is compulsory to submit the Assignment before filling in the Term-End Examination form.
- It is mandatory to register for a course before appearing in the Term-End Examination of the course. Otherwise, your result will not be declared.



School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2023)

Assignment

(To be done after reading the course material)

1. Write the output of the following C codes, with proper justification for each. (10)

```
i) main()
{
    int i = 5, j = 6, k = 7;
    printf("%d", i++ - ++j + ++k);
}

ii) main()
{
    char day[10] = "SUNDAY";
    day[0] = 77;
    day[1] = 79;
    printf("%s", day);
}

iii) main()
{
    int i = 3;
    while(i--)
    {
        int i = 1;
        printf("%d ", i);
        i++;
    }
}

iv) int f(int n)
{
    if(n < 1)
        return n;
    else
        return n*n + f(n-1);
}
main()
{
    printf("%d", f(5));
}

v) struct employee
{
    char name[20];
    int id;
    long salary;
}emp = {"Piyush", 1, 50000};
main()
{
    printf("Name = %s \n", emp.name);
    printf("ID = %d\n", emp.id);
    printf("Salary = %d", emp.salary);
}
```

2. (a) What is a pointer variable to a pointer? Where is it used? explain with an example. (4)
- (b) Arrange the following operators in descending order of their priority. If any two operators have the same priority, then specify their associativity. (4)
- $+ = \quad \% \quad + \quad [] \quad != \quad - \quad () \quad - >$
- (c) Write a program that reads the date of birth of a person from the keyboard and prints his/her age in years, months and days. The date of birth is supposed to be in the format DD-MM-YYYY. (4)
- (d) Give an example to illustrate the use of ternary **if-then-else** statement. (3)
3. (a) What is wrong with the following declaration? Explain. (2)
- float** *number = 2.30;
- (b) Write a C program that reads a list of positive integers from keyboard, and prints the number of integers divisible by 2 or 3. (3)
- (c) Given any two real matrices A and B with same dimensions, define the matrix A^B to be the matrix with ij th entry as $a_{ij}^{b_{ij}}$ if $a_{ij} \neq 0$ and 0 otherwise. Write a program that reads two matrices A and B from the keyboard and prints the matrix A^B . The program must float an error message if the dimensions of A and B mismatch. (5)
4. (a) Convert the following nested do-while loop into a nested for loop:

```

i = 0;
do
{
    i = i+1;
    j = i;
    do
    {
        if( (i+j)%2 == 0 )
            printf("%d\n", i);
        else
            printf("%d\n", j);
        j = j+2;
    }while(j <= 10);
}while(i <= 5);

```

- Verify that you get the same output in each case. (4)
- (b) Give three different situations where the keyword **typedef** is used. (3)
- (c) What do you understand by an automatic variable? How does it differ from a static variable? Explain. (3)
5. (a) Write a macro to compute the surface area of a cone. (3)
- (b) Write a C program that uses pointers and a single function to compute the two roots of a quadratic equation, given its coefficients. Your function must be able to cope with the four cases: (7)
- i. non-existent roots
 - ii. real and different roots
 - iii. real and equal roots
 - iv. complex roots

6. (a) What does the following C function compute? Discover. (5)

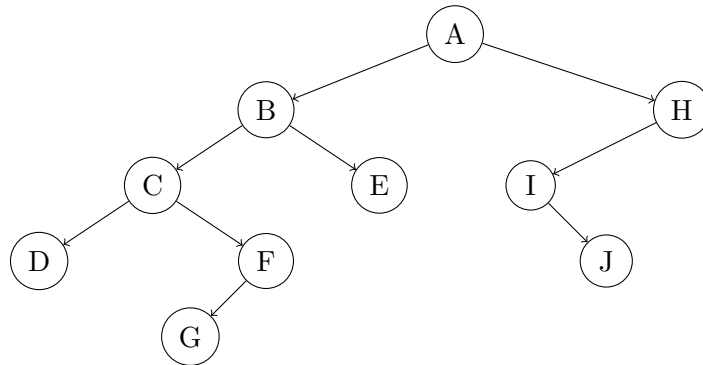
```
int some_fun(int n)
{
    if(n%2 == 0)
        return 2;
    int d, s = sqrt(n);
    for(d = 3; d <= s; d = d+2)
        if(n%d == 0)
            return d;
    return n;
}
```

- (b) Write statements to accomplish each of the following. Assume the structure

```
struct person
{
    char lastName [10];
    char City [20];
    int Age;
};
```

has been defined and that the file is already open for writing.

- i. Initialize the file "persondata.dat" so that there are 100 records with lastName="", City="" and Age = 0.
 - ii. Input 10 last names, first names and ages and write them to the file (5)
7. (a) Write the inorder, preorder and postorder traversals of the following binary search tree. (3)



- (b) How will you store the following sparse matrix in vector and linked list representation so that only nonzero elements are stored? (4)

$$\begin{bmatrix} 2 & 3 & 0 & 0 & -1 \\ 1 & 0 & 2 & 1 & 0 \\ 0 & 4 & 5 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 9 & 0 & 0 & 0 & 0 \end{bmatrix}$$

- (c) Based on Example 5 in Unit 12, write functions to add and multiply polynomials of real variables. (8)
8. Write a function that evaluates an expression in RPN that is given as a string. (10)

9. (a) Explain the meaning of the terms garbage collection, fragmentation, relocation and compaction. (5)
- (b) What do you understand by file organisation? Explain the methods of file organisation. (5)