



## INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

### Programming in C and C++ (CSC-101)

#### Assignment 4

**40 marks**

*Note : (No function / matrix are allowed to be used)*

Q-1) Write a C program that prints numbers from 1 to  $n \times n$  arranged in a clockwise spiral pattern inside an  $n \times n$  grid, without using any 2D arrays or function calls.

Enter n: 5

1	2	3	4	5
16	17	18	19	6
15	24	25	20	7
14	23	22	21	8
13	12	11	10	9

Q-2) Write a C program to print concentric square patterns which use only while loops. It only takes an odd number as input. If the user gives an even number it gives an error.

#### Output

```
Enter an odd integer (n >= 1): 11
*****
*           *
*  * * * * *  *
* *           * *
* *  * * *  * *
* * * * * * *
* * * * * * *
* *  * * *  * *
* *           * *
*  * * * * *  *
*           *
*****
```

3) Write a C program to find all perfect numbers between 1 and 100,000. A number  $m$  is called a perfect number if the sum of all its positive divisors, excluding the number itself, equals  $m$ . In other words, if  $\sigma(m) = m$ , where  $\sigma(m)$  is the sum of all positive divisors of  $m$ , excluding  $m$  itself. For example,  $\sigma(12) = 1 + 2 + 3 + 4 + 6 = 16$ ,

so 12 is not a perfect number because  $16 \neq 12$ , 28 is a perfect number because  $\sigma(28) = 1 + 2 + 4 + 7 + 14 = 28$ .

4) Write a C program that performs a sequence of arithmetic operations on integers using a switch statement. Operators can be +, -, \*, /, or % and are treated as equal precedence and the expression ends with =. The evaluation happens from left to right. Your program should compute the result, handle division/modulo by zero, and report invalid operators or if the expression is invalid i.e two operator/number consecutive and all possible checking should be done. Use switch for operation control, and include appropriate logic where appropriate.

Output:

Input ending with = :  
100 + 20 \* 2 / 5 - 10 =

Output:  
Result = 18