भारतीय सूचना प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Information Technology Guwahati

COMPUTER PROGRAMMING LAB (CS110)
ASSIGNMENTS–04

[Note: Do not use the `scanf()` function, `switch-case`, and/or `do-while` construct. Write each program twice: first using a `for` loop and then using a `while` loop.]

1. Realize the output of the following program:

```c
#include <stdio.h>

int main() {

    int n = 2;

    printf("Line: %d, n = %d\n", __LINE__, n);
    while(printf("Line: %d, n = %d\n", __LINE__, n), n) {
        printf("Line: %d, n = %d\n", __LINE__, n--);
    }
    printf("Line: %d, n = %d\n", __LINE__, n);

    return 0;
}
```

2. Realize the output of the following program:

```c
#include <stdio.h>

int main() {

    int n = 2;

    printf("Line: %d, n = %d\n", __LINE__, n);
    while(n, printf("Line: %d, n = %d\n", __LINE__, n)) { //forever
        printf("Line: %d, n = %d\n", __LINE__, n--);
    }
    printf("Line: %d, n = %d\n", __LINE__, n);

    return 0;
}
```

3. Realize the output of the following program:

```c
#include <stdio.h>

int main() {
    int n = 2;

    printf("Line: %d, n = %d\n", __LINE__, n);
    for (
        printf("Line: %d, n = %d\n", __LINE__, n);
        printf("Line: %d, n = %d\n", __LINE__, n), n;
        printf("Line: %d, n = %d\n", __LINE__, n), n--
    ) {
        printf("Line: %d, n = %d\n", __LINE__, n);
    }
    printf("Line: %d, n = %d\n", __LINE__, n);

    return 0;
}
```

4. Realize the output of the following program:

```c
#include <stdio.h>

int main() {
    int n = 2;

    printf("Line: %d, n = %d\n", __LINE__, n);
    for (
        printf("Line: %d, n = %d\n", __LINE__, n);
        n, printf("Line: %d, n = %d\n", __LINE__, n);
        printf("Line: %d, n = %d\n", __LINE__, n), n--
    ) { //forever
        printf("Line: %d, n = %d\n", __LINE__, n);
    }
    printf("Line: %d, n = %d\n", __LINE__, n);

    return 0;
}
```

5. Write separate programs in C to print the following patterns. Each of them is associated with a control variable `n`. The examples are associated with `n = 4`.

   i. `****`

   ii. `#`
   `#`
   `#`
   `#`

iii.
```
$$$$
$$$$
$$$$
$$$$
```

iv.
```
?
??
???
????
```

v.
```
    %
   %%
  %%%
 %%%%
```

vi.
```
@@@@
@@@
@@
@
```

vii.
```
&&&&
 &&&
  &&
   &
```

viii.
```
1234
123
12
1
```

ix.
```
4321
 321
  21
   1
```

x.
```
4
33
222
1111
```

xi.
```
    0
   01
  012
 0123
```

xii. For this, consider `n = 5` unlike others.

```
1
```

```
23
456
7890
12345
```

xiii.
```
1
1 2 3
1 2 3 4 5
1 2 3 4 5 6 7
1 2 3 4 5
1 2 3
1
```

xiv.
```
****
  *
 *
****
```

xv.
```
****
*  *
*  *
****
```

xvi.
```
<<<<(      )   >
<<< ((    ))  >>
<<  (((  )))  >>>
<   ((((  ))))>>>
```

xvii.
```
(((())))
(((  )))
((    ))
(      )
((    ))
(((  )))
(((())))
```

xviii.
```
1
010
10101
0101010
10101
010
1
```

xix.
```
(((())))   1   (((())))
```

```
(((  )))  101  (((  )))
((    )) 10101 ((    ))
(      )1010101(      )
((    )) 10101 ((    ))
(((  )))  101  (((  )))
((((  ))))   1   ((((  ))))
```

xx.

```
    *
   * *
  * * *
 * * * *
  * * *
   * *
    *
```

6. Write separate programs in C to compute the sum of the first n terms of the following series:

   i. $S_1 = 1 + \frac{1}{2} + \frac{1}{3} + \cdots$

   ii. $S_2 = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots$

   iii. $S_\pi = 4\left(\frac{1}{1} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots\right)$

   iv. $S_{\log(1+x)} = x - \frac{x^2}{2} + \frac{x^3}{3} - \cdots$

   v. $S_{e^x} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$

   vi. $S_{\sin(x)} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$

   vii. $S_{\cos(x)} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \cdots$

7. A cricket match is going on. First five overs are done. The runs accumulated in these five overs are stored in five integers variables: `r1`, `r2`, `r3`, `r4`, and `r5`. Write a program in C to print a horizontal bar chart to show runs per over. If the values of these five variables are, respectively, 4, 2, 0, 10, 7, the chart needs to be as follows.

```
Over 1: ####
Over 2: ##
Over 3:
Over 4: ##########
Over 5: #######
```

8. Write a program in C to find the the least common multiple (LCM) of two numbers.
9. Write a program in C to find the greatest common divisor (GCD) of two numbers.
10. Write a program in C to count the number of digits in a number.
11. Write a program in C to print all even numbers between $1 - n$, where n is a positive integer.
12. Write a program in C to print the multiplication table of any number.
13. Write a program in C to print the sum and product of digits of an integer.
14. Write a program in C to reverse a number.
15. Write a program in C to find whether a given positive integer is prime or not.
16. Write a program in C to print the prime numbers that are less than a given value `n`.
17. Write a program in C to find the factorial of a number.
18. Write a program in C to check whether a number is a Strong number or not.
19. Write a program in C to print the factors of a given number.
20. Write a program in C to print the Fibonacci series up to the first n terms.
21. Write a program in C to find x^n for a given positive real value x and a positive integer n.
22. Write a program in C to check whether a number is Perfect number or not.
23. Write a program in C to find whether a given number is odd or even. You cannot use the `?:` operator and the `if-else` construct.
24. Write a program in C to find if a year is a leap year. You cannot use `&&` operaor, `||` operator, `?:` operator, and any `if-else` construct.
25. Write a program in C to find if a year is a leap year. You cannot use `&&` operaor, `||` operator, `?:` operator, `break`, `continue`, and any `if-else` construct.