Course Name:	PROGRAMMING IN C	Semester:	II
Date of Performance:	27-01-2025	DIV/ Batch No:	[redacted]
Student Name:	[redacted]	Roll No:	[redacted]

Experiment No: 3

Title: Write a program in C to demonstrate use of looping control structures

Aim and Objective of the Experiment:

Write a menu-driven program for the following option

a. To find whether a number is palindrome or not. (e.g. 1221 is palindrome) using while loop

b. To calculate the sum of the Fibonacci series up to 'n' terms(use do-while loop only)

c. Write a program in C to make such a pattern as a right angle triangle with a number that will repeat a number in a row.

COs to be achieved:

CO: Apply basic concepts of C programming for problem-solving.(CO1 and CO2).

Theory:

Loops in programming are used to repeat a block of code until the specified condition is met. A loop statement allows programmers to execute a statement or group of statements multiple times without repetition of code.

There are mainly two types of loops in C Programming:

- Entry Controlled loops: In Entry controlled loops the test condition is checked before entering the main body of the loop. **For Loop and While Loop is Entry-controlled loops**.
- Exit Controlled loops: In Exit controlled loops the test condition is evaluated at the end of the loop body. The loop body will execute at least once, irrespective of whether the condition is true or false. **do-while Loop is Exit Controlled loop**.

for Loop

for loop in C programming is a repetition control structure that allows programmers to write a loop that will be executed a specific number of times. for loop enables programmers to perform n number of steps together in a single line.

Syntax:

```
for (initialize expression; test expression; update expression)
{
```

```
        //
        // body of for loop
        //
    }
```

For Example:-

```
for(int i = 0; i < n; ++i)
{
   printf("Body of for loop which will execute till n");
}
```

While Loop

While loop does not depend upon the number of iterations. In for loop the number of iterations was previously known to us but in the While loop, the execution is terminated on the basis of the test condition. If the test condition will become false then it will break from the while loop else body will be executed.

```
while (test_expression)
{
   // body of the while loop

   update_expression;
}
```

do-while Loop

The do-while loop is similar to a while loop but the only difference lies in the do-while loop test condition which is tested at the end of the body. In the do-while loop, the loop body will execute at least once irrespective of the test condition.

```
do
{
   // body of do-while loop

   update_expression;

} while (test_expression);
```

Problem Statements:

1. To find whether a number is palindrome or not. (e.g. 1221 is palindrome) using while loop

2. To calculate the sum of the Fibonacci series up to ‘n’ terms(use do-while loop only)
3. Write a program in C to make such a pattern like a right angle triangle with a number which will repeat a number in a row or as pattern given below

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

Code :

```
#include <stdio.h>

// Function to check if a number is a palindrome
int isPalindrome(int num) {
    int originalNum = num, reversedNum = 0, remainder;
    while (num != 0) {
        remainder = num % 10;
        reversedNum = reversedNum * 10 + remainder;
        num /= 10;
    }
    return originalNum == reversedNum;
}

// Function to calculate the sum of the Fibonacci series up to 'n' terms
int fibonacciSum(int n) {
    int a = 0, b = 1, sum = a + b, count = 2, temp;
    if (n == 1) return a;
    if (n == 2) return a + b;

    do {
        temp = a + b;
        sum += temp;
        a = b;
        b = temp;
        count++;
    } while (count < n);
    return sum;
```

```
}

// Function to print a pattern as a right-angle triangle
void printPattern(int n) {
    int a, b, c, d;
    printf("enter row: ");
    scanf("%d", &a);
    for(b = 1; b <= a; b++) {
    for(c = 1; c <= (a - b); c++) {
          printf("   ");}
    for(d = 1; d <= (2 * b - 1); d++) {
          if(d % 6 != 0) {
             printf("*  ");
          } else {
             printf("   ");}}
       printf("\n");}
    }
}

int main() {
    int choice, num, n;

    do {
       printf("\nMenu:\n");
       printf("a. Check if a number is palindrome\n");
       printf("b. Calculate sum of Fibonacci series up to 'n' terms\n");
       printf("c. Print a right-angle triangle pattern\n");
       printf("d. Exit\n");
       printf("Enter your choice: ");
       scanf(" %c", &choice);

       switch (choice) {
          case 'a':
             printf("Enter a number: ");
             scanf("%d", &num);
             if (isPalindrome(num)) {
                printf("%d is a palindrome.\n", num);
             } else {
                printf("%d is not a palindrome.\n", num);
             }
             break;

          case 'b':
             printf("Enter the number of terms for the Fibonacci series: ");
             scanf("%d", &n);
```

```
            if (n <= 0) {
                printf("Please enter a positive integer.\n");
            } else {
                printf("Sum of the first %d terms of the Fibonacci series is: %d\n", n,
fibonacciSum(n));
            }
            break;

        case 'c':
            printf("Enter the number of rows for the pattern: ");
            scanf("%d", &n);
            printPattern(n);
            break;

        case 'd':
            printf("Exiting program.\n");
            break;

        default:
            printf("Invalid choice. Please try again.\n");
      }
   } while (choice != 'd');

   return 0;
}
```

Output:

```
Menu:
a. Check if a number is palindrome
b. Calculate sum of Fibonacci series up to 'n' terms
c. Print a right-angle triangle pattern
d. Exit
Enter your choice: a
Enter a number: 1221
1221 is a palindrome.

Menu:
a. Check if a number is palindrome
b. Calculate sum of Fibonacci series up to 'n' terms
c. Print a right-angle triangle pattern
d. Exit
Enter your choice: b
Enter the number of terms for the Fibonacci series: 5
Sum of the first 5 terms of the Fibonacci series is: 7

Menu:
a. Check if a number is palindrome
b. Calculate sum of Fibonacci series up to 'n' terms
c. Print a right-angle triangle pattern
d. Exit
Enter your choice: c
Enter the number of rows for the pattern: 2
enter row: 2
   *
*  *  *
```

Post Lab Subjective/Objective type Questions:

1. Write a program in C to display the n terms of a harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms

Ans: Code

```
# include <stdio.h>
int main ()
{
   int n,i;
   double sum = 0.0;
   printf ("Enter the no.of terms: ");
   scanf ("%d" , &n);
   printf ("Harmonic series: \n ");
   for (i=1; i<=n; i++)
   {
      printf("1/%d ",  i);
      if (i<n)
      {
         printf ("+");
      }
      sum += 1.0/i;
   }
```

```
    printf (" \n Sum of the harmonic series: %.2f ", sum);
    return 0;
}
```

Output

```
Enter the no.of terms: 5
Harmonic series:
 1/1 +1/2 +1/3 +1/4 +1/5
 Sum of the harmonic series: 2.28
Process returned 0 (0x0)   execution time : 2.021 s
Press any key to continue.
```

2. Write a C program that displays the n terms of square natural numbers and their sum.
1 4 9 16 ... n Terms

Ans: Code

```
# include <stdio.h>
int main ()
{
    int n,i;
    int sum =0;
    printf ("Enter the no.of terms: ");
    scanf ("%d" , &n);
    printf ("Square natural numbers: ");
    for (i=1; i<=n; i++)
    {
        int sq =i*i;
        printf ("%d", sq);
        if (i<n)
        {
            printf (",");
        }
        sum += sq;
    }
    printf ("\n Sum of the Square natural numbers : %d \n" , sum);
    return0;
}
```

Output

```
Enter the no.of terms: 5
Square natural numbers: 1,4,9,16,25
 Sum of the Square natural numbers : 55

Process returned 0 (0x0)   execution time : 3.419 s
Press any key to continue.
```

Conclusion:

In this module we learnt about different types of loops used in C programming. Loops in programming are used to repeat a block of code until the specified condition is met. We learnt about for loop, while loop and do-while loop. Also learnt to write a program for star pattern, Fibonacci series and palindrome numbers.

Signature of faculty in-charge with Date: