CS1160
Lab 4: Loops 1

While loop

A while loop in C programming repeatedly executes a target statement as long as a given condition is true.

```
while (condition expression) {
    // statements to be executed many times until the condition is false
    Incremental expression;
}
```

Example:

1. Write a C program that **reads in** an **integer (n)**. It will then **find** and **print** the result of the following formula:

$$Y = \sum_{k=4}^{n}(K - 3)$$

```c
int main() {
    int n, k = 4;  // start from k = 4
    double y = 0;

    // Read n
    printf("Enter an integer value for n (n >= 4): ");
    scanf("%d", &n);

    // Validate input
    if (n < 4) {
        printf("Invalid input! n must be greater than or equal to 4.\n");
        return 0;
    }
```

1

```c
    // Compute Y using while loop
    while (k <= n) {
        y += (k - 3);
        k++;
    }

    // Display result
    printf("Y = %f\n", y);

    return 0;
```

2

```
Output                          3
Enter an integer value for n (n >= 4): 5
Y = 3.000000
```

Sara Abu Sa'aleek

Do-While loop

Unlike for and while loops, which test the loop condition at the top of the loop, the do...while loop in C programming checks its condition at the bottom of the loop.

```
Initial expression;
do {
   // statements to be executed many times until the condition is false
   Incremental expression;
} while (condition expression);
```

Example: Write a C program with the following specifications:

a) The program reads integer value (x).

b) The program should print out (**Y**) using the following formula:

$$Y = X + \frac{x^2}{3} + \frac{x^2}{5} + \frac{x^2}{7} + \cdots + \frac{x^2}{15}$$

- The program must verify that **X** value entered **is positive** and should ask the user to re-enter the values if any value entered **is negative**.

```c
#include <stdio.h>
int main() {
    int x;
    double y = 0.0;
    // Input validation: X must be positive
    do {
        printf("Enter a positive integer value for X: ");
        scanf("%d", &x);

        if (x <= 0) {
            printf("Invalid input! X must be positive.\n");
        }
    } while (x <= 0);
    // Compute Y = X + X^2/3 + X^2/5 + X^2/7 + ... + X^2/15
    y = x;  // first term
    for (int i = 3; i <= 15; i += 2) {
        y += x*x /i;
    }
    printf("Y = %.2lf\n", y);
    return 0;
}
```

Sara Abu Sa'aleek

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For Loop

It is used to decide whether a certain statement or block of statements will be executed or not based on a certain condition, if it is true then the block of statement is executed otherwise not.

```
for (counter ; condition expression; incremental expression)
{
    // statements to be executed many times until the condition is false
}
```

Example: Write a C program that reads the marks of N students. The program should display:

✓ Whether each student "PASS" or "FAIL".

✓ The number of passed students and the number of failed students.

✓ The average

```c
#include <stdio.h>

int main() {
    int n, i;
    float mark, sum = 0;
    int passCount = 0, failCount = 0;

    printf("Enter number of students: ");
    scanf("%d", &n);

    for (i = 1; i <= n; i++) {
        printf("Enter mark of student %d: ", i);
        scanf("%f", &mark);

        sum += mark;

        if (mark >= 50) {
            printf("Student %d: PASS\n", i);
            passCount++;
        } else {
            printf("Student %d: FAIL\n", i);
            failCount++;
        }
    }
```

1

```c
    printf("\nNumber of Passed Students: %d", passCount);
    printf("\nNumber of Failed Students: %d", failCount);
    printf("\nAverage Marks: %.2f\n", sum / n);

    return 0;
}
```

2

```
Output                                          3
Enter number of students: 3
Enter mark of student 1: 49
Student 1: FAIL
Enter mark of student 2: 66
Student 2: PASS
Enter mark of student 3: 75
Student 3: PASS

Number of Passed Students: 2
Number of Failed Students: 1
Average Marks: 63.33
```

Sara Abu Sa'aleek

Tasks

2. Write a C program using for loop that reads the ages of N people. The program should display:

Whether each person is a "Minor" or an "Adult".

- The total number of minors and adults.
- The average age.

Sample Output

```
Enter number of people: 4
Enter age of person 1: 17
Person 1: Minor
Enter age of person 2: 25
Person 2: Adult
Enter age of person 3: 12
Person 3: Minor
Enter age of person 4: 30
Person 4: Adult

Number of Adults: 2
Number of Minors: 2
Average Age: 21.00
```

Sara Abu Sa'aleek

- **Write a C program with the following specifications using do-while:**

  - The program reads an integer value (**x**).
  - The program should print out (**Y**) using the following formula:

$$Y = X - \frac{X^3}{2} + \frac{X^3}{4} - \frac{X^3}{6} + \frac{X^3}{8}$$

  - The program must verify that **X** value entered is **positive** and should ask the user to re-enter the value if any value entered is **negative**.

Write a C program that reads an integer (n). It will then find and print the result of the following formula using while loop:

$$Y = \sum_{k=1}^{n} (k^2 + 2)$$

Sample Output

```
Output
Enter a positive integer value for n: 2
Y = 9
```

Sara Abu Sa'aleek