5. Control Structures

- Sequential execution
- Decision making
  - if
  - if-else
  - else-if ladder
  - switch
- Looping
  - for
  - while
  - do-while
- Loop control
  - break
  - continue

Chapter Overview

Control Structures in C:

- Introduction to control structures
- Sequential statements
- Decision making statements
- Looping statements
- Loop control statements

Control structures control the flow of program execution.

What are Control Structures?

- Control structures decide which statement executes
- Used for:
  - Decision making
  - Repetition
- Makes programs logical and powerful

Types of Control Structures

- **Sequential statements**
- **Branching statements**
- **Looping statements**

Sequential Statements

- Default execution order in C
- Statements execute line by line
- No condition involved

example:

```
a = 10;
b = 20;
c = a + b;
```

Types of Control Structures

Branching Statements:

- Used for decision making
- Types:
  - if
  - if–else
  - Nested if–else
  - else-if ladder
  - switch
  - goto (concept only)

Simple if Statement

- Executes block only if condition is true

```
if (a > b) {
    printf("a is greater");
}
```

Types of Control Structures

if–else Statement

- Executes one block if true
- Executes another if false

```
if (a % 2 == 0)
    printf("Even");
else
    printf("Odd");
```

Nested if–else

- if–else inside another if–else
- Used for multiple conditions

```
if (a > b) {
    if (a > c)
        printf("a is largest");
}
```

Types of Control Structures

else-if Ladder

- Used when multiple conditions are checked

```
if (m ⩾ 80) grade = 'A';
else if (m ⩾ 60) grade = 'B';
else grade = 'C';
```

switch Statement

- Used for menu-driven programs
- Works with constant expressions

```
switch(choice) {
    case 1: printf("Add"); break;
    case 2: printf("Subtract"); break;
    default: printf("Invalid");
}
```

Types of Control Structures

goto Statement

- Transfers control to a labeled statement
- Generally avoided
- Conceptual understanding only

```
goto label;
label:
printf("Hello");
```

Looping Statements

Types:

- **for loop**
- **while loop**
- **do-while loop**
- **Nested loops**

for Loop

- Entry-controlled loop
- Used when number of iterations is known

```
for (i = 1; i ⩽ 10; i++)
    printf("%d", i);
```

while Loop

- Entry-controlled loop
- Condition checked first

```
while (i ⩽ 10) {
    printf("%d", i);
    i++;
}
```

Looping Statements

do–while Loop

- Exit-controlled loop
- Executes at least once

```
do {
    printf("%d", i);
    i++;
} while (i ⩽ 10);
```

Nested Loops

- Loop inside another loop
- Used in pattern printing

```
for(i=1;i⩽3;i++){
    for(j=1;j⩽3;j++)
        printf("*");
}
```

Looping Statements

Loop Interruption Statements

- Used to control loop execution:
  - break
  - continue

break Statement

- Terminates the loop immediately

```
if (i == 5)
    break;
```

continue Statement

- Skips current iteration
- Continues with next iteration

```
if (i == 5)
    continue;
```

Practice Time:

- Even / Odd
- Largest of 3 numbers
- Multiplication table
- Pattern printing

Coding Questions

Level 1: Basics

- Write a program to check whether a number is positive or negative.
- Write a program to check whether a number is even or odd.
- Write a program to find the greater of two numbers.
- Write a program to check whether a number is divisible by 5.
- Write a program to print numbers from 1 to 10 using a loop.

Level 2: Decision Making (if–else, else-if)

- Write a program to find the largest of three numbers.
- Write a program to check whether a student is pass or fail (pass ≥ 40).
- Write a program to assign grade based on marks using else-if ladder.
- Write a program to check whether a year is a leap year.
- Write a program to check whether a character is a vowel or consonant.

Coding Questions

Level 3: switch Statement

- Write a program to implement a simple calculator using switch.
- Write a program to display day name based on day number.
- Write a program to display month name based on month number.

Level 4: Looping (for, while, do-while)

- Write a program to print multiplication table of a number.
- Write a program to find the sum of first n natural numbers.
- Write a program to find the factorial of a number.
- Write a program to reverse a number.
- Write a program to count digits of a number.

Coding Questions

Level 5: Nested Loops & Patterns

- **Print the following pattern:**

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

- **Print the following pattern:**

```
1
12
123
1234
```

- **Print the following pattern:**

```
1
22
333
4444
```

Coding Questions

Level 6: Loop Control Statements

- Write a program to demonstrate the use of break.
- Write a program to demonstrate the use of continue.
- Write a program to stop loop execution when a specific number is entered.

Level 7: Advanced Logic (Day 4 Challenge)

- Write a program to check whether a number is a palindrome.
- Write a program to check whether a number is an Armstrong number.
- Write a program to find the HCF and LCM of two numbers.
- Write a program to display all prime numbers between 1 and 100.
- Write a program to check whether a number is prime.

Bonus Challenge

- Write a menu-driven program using loop and switch.