

**Course
&
Test Series**

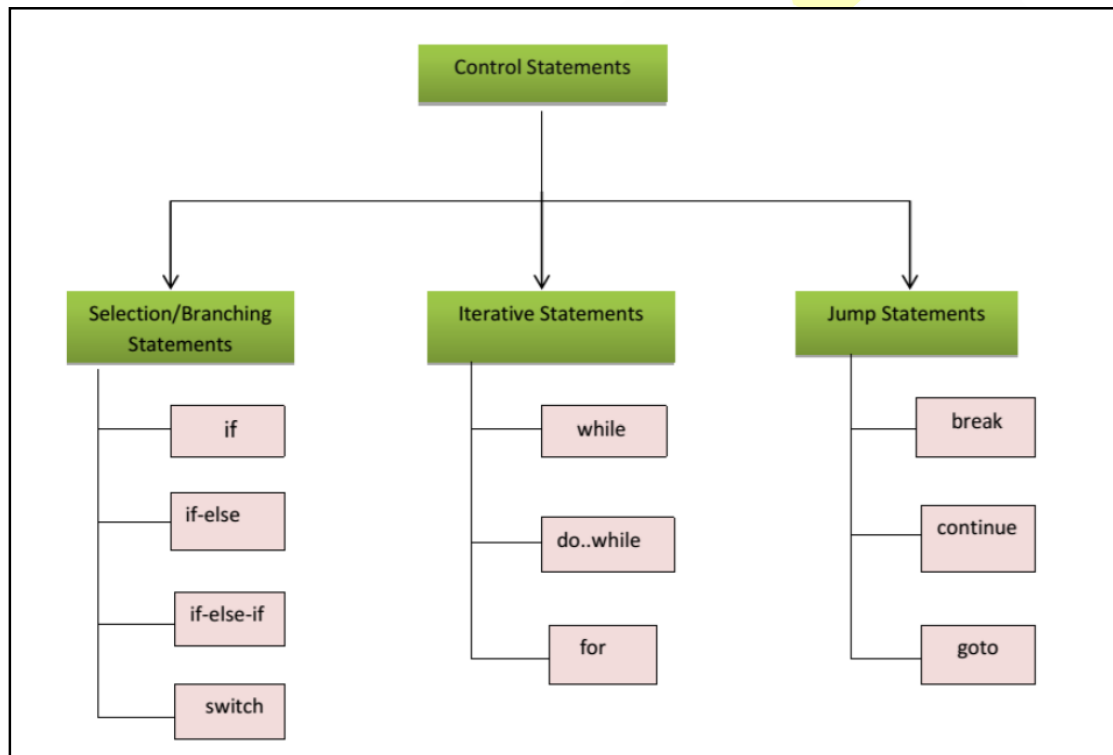
Introduction to 'C' Language - Module 3

Conditional Statements and Loops in C

Control Statements

In C, programs are executed sequentially in the order of which they appear. This condition does not hold true always. Sometimes a situation may arise where we need to execute a certain part of the program.

Also, it may happen that we may want to execute the same part more than once. Control statements enable us to specify the order in which the various instructions in the program are to be executed. They define how the control is transferred to other parts of the program. Control statements are classified in the following ways:



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-  **ICSE**
-  **NTSE**
-  **Banking & Insurance**
-  **Central Govt. Service**
-  **State Govt. Services**
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Selection Statements: The selection statements are also known as Branching or Decision Control Statements.

Introduction to Decision Control Statements

Sometime we come across situations where we have to make a decision. E.g. If the weather is sunny, I will go out & play, else I will be at home. Here my course of action is governed by the kind of weather.

If it's sunny, I can go out & play, else I have to stay indoors. I choose an option out of 2 alternate options. Likewise, we can find ourselves in situations where we have to select among several alternatives. We have decision control statements to implement this logic in computer programming.

Decision making structures require that the programmer specify one or more conditions to be evaluated or tested by the program, along with a statement or statements to be executed if the condition is determined to be true, and optionally, other statements to be executed if the condition is determined to be false.

1. if Statement

The if statement is used to execute a block of code only if a specified condition is true.

Syntax:

```
c  
  
if (condition) {  
    // Code to be executed if the condition is true  
}
```

Solved Question: Write a program to check if a given number is positive.

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```
c Copy code
#include <stdio.h>

int main() {
    int num;
    printf("Enter a number: ");
    scanf("%d", &num);

    if (num > 0) {
        printf("%d is positive.\n", num);
    }

    return 0;
}
```

Test Cases and Outputs

Test Case 1: Input is a Positive Number
Input: `5`
Output:

```
csharp Copy code
Enter a number: 5
5 is positive.
```

Test Case 2: Input is Zero
Input: `0`
Output:

```
css Copy code
Enter a number: 0
```

Since `0` is not greater than `0`, the `if` condition is false, and nothing is printed after the prompt.

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Assignment

- Ques 1: Write a program to check if a given character is a vowel (considering only lowercase vowels).
- Ques 2: Write a program to check if a given number is divisible by 10.
- Ques 3: Write a program to check if a given number is zero.
- Ques 4: Write a program to check if a given number is a multiple of 5.
- Ques 5: Write a program to check if a given number is negative.

2. If - else statement:

The if-else statement in C is a control flow statement that allows you to execute a block of code based on a condition. It consists of the if keyword, followed by a condition in parentheses, and a block of code in curly braces. If the condition is true, the block of code within the if statement is executed. If the condition is false, the block of code within the else statement (if provided) is executed instead.

Syntax

The basic syntax of the `if-else` statement is:

```
c Copy code  
  
if (condition) {  
    // Code to execute if condition is true  
} else {  
    // Code to execute if condition is false  
}
```

Solved Question: Check if a Number is Even or Odd.

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```
c Copy code

#include <stdio.h>

int main() {
    int num;

    // Prompt the user to enter a number
    printf("Enter an integer: ");
    scanf("%d", &num);

    // Check if the number is even or odd
    if (num % 2 == 0) {
        printf("%d is even.\n", num);
    } else {
        printf("%d is odd.\n", num);
    }

    return 0;
}
```

Explanation:

Include Header File:

#include <stdio.h>: This line includes the standard input-output library which is necessary for using printf and scanf.

Main Function:

int main(): This is the main function where the execution of the program begins.

Declare Variable:

int num;: Declare an integer variable num to store the user's input.

Prompt User Input:

printf("Enter an integer: ");: Print a message asking the user to enter an integer.

scanf("%d", &num);: Read the integer input from the user and store it in the variable num.

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Check if Even or Odd:

if (num % 2 == 0): Use the modulus operator % to check if the remainder when num is divided by 2 is 0. If true, the number is even.
printf("%d is even.\n", num); If the condition is true, print that the number is even.

else: If the condition is false, it means the number is odd.
printf("%d is odd.\n", num); Print that the number is odd.

Return Statement:

return 0; Return 0 to indicate that the program executed successfully.

Assignment

- Ques 1: Write a program to check if a given integer is even or odd.
Ques 2: Write a program to check if a given number is positive, negative, or zero.
Ques 3: Write a program to check if a given character is a vowel or a consonant.
Ques 4: Write a program to check if a given year is a leap year.
Ques 5: Write a program to check if a given number is divisible by both 3 and 5.
Ques 6: Write a program to check if a given number is prime.
Ques 7: Write a program to check if a given number is within the range of 1 to 100.
Ques 8: Write a program to check if three given sides can form a valid triangle.
Ques 9: Write a program to check if a student passed or failed based on marks in three subjects. A student passes if the average of the marks is 50 or above.

3. Nested if-else Statements:

In C programming, nested if-else statements are if or else statements that are nested inside another if or else statement. This allows for more complex decision-making processes, where multiple conditions need to be checked in a hierarchical manner.

Syntax of Nested if-else Statements:

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Syntax

The general syntax for nested `if-else` statements is as follows:

```
c Copy code
if (condition1) {
    // Code to be executed if condition1 is true
    if (condition2) {
        // Code to be executed if condition2 is true
    } else {
        // Code to be executed if condition2 is false
    }
} else {
    // Code to be executed if condition1 is false
    if (condition3) {
        // Code to be executed if condition3 is true
    } else {
        // Code to be executed if condition3 is false
    }
}
```

Solved Example: Let's look at a practical example where nested if-else statements are used. This example determines a student's grade based on their marks.

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```
c
#include <stdio.h>

int main() {
    int marks;
    printf("Enter your marks: ");
    scanf("%d", &marks);

    if (marks >= 0 && marks <= 100) { // Check if marks are within a valid range
        if (marks >= 90) {
            printf("Grade: A\n");
        } else {
            if (marks >= 80) {
                printf("Grade: B\n");
            } else {
                if (marks >= 70) {
                    printf("Grade: C\n");
                } else {
                    if (marks >= 60) {
                        printf("Grade: D\n");
                    } else {
                        printf("Grade: F\n");
                    }
                }
            }
        }
    } else {
        printf("Invalid marks entered.\n");
    }

    return 0;
}
```

Explanation:

- Outer if Statement: Checks if the marks entered are within the valid range (0 to 100).
- Nested if-else Statements: Within the valid range check, several nested if-else statements determine the grade based on the marks:
 - If marks are 90 or above, grade is A.
 - If marks are 80 to 89, grade is B.
 - If marks are 70 to 79, grade is C.



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- If marks are 60 to 69, grade is D.
- If marks are below 60, grade is F.

3. Outer else Statement: If the marks entered are outside the valid range, an error message is printed.

Assignment

Ques 1: Write a program to determine the grade of a student based on their marks in a range from 0 to 100. The grading system is as follows:

- Marks ≥ 90 : Grade A
- Marks ≥ 80 and < 90 : Grade B
- Marks ≥ 70 and < 80 : Grade C
- Marks ≥ 60 and < 70 : Grade D
- Marks < 60 : Grade F

Ques 2: Write a program to check if a person is eligible to vote based on their age and classify them into different age groups. The program should work as follows:

- Prompt the user to enter their age.
- Validate that the entered age is a positive number.
- If the age is 18 or older, the person is eligible to vote.
- If the person is eligible to vote, further classify them into the following age groups:
 - Young Adult: 18 to 29 years old
 - Adult: 30 to 59 years old
 - Senior Citizen: 60 years and older
- If the person is not eligible to vote (under 18 years old), classify them into:
 - Child: Under 13 years old
 - Teenager: 13 to 17 years old
- If the age entered is not valid (e.g., negative number), display an error message.

Ques 3: Write a program to determine the type of triangle based on the lengths of its three sides. The program should perform the following steps:

- Prompt the user to enter the lengths of the three sides of the triangle.
- Validate that the entered side lengths are positive numbers.
- Check if the triangle is valid, i.e., the sum of the lengths of any two sides must be greater than the length of the third side.
- If the triangle is valid, determine its type:
 - Equilateral Triangle: All three sides are of equal length.

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- Isosceles Triangle: Two sides are of equal length, but the third side is different.
- Scalene Triangle: All three sides are of different lengths.
- If the triangle is not valid, display an error message.

Ques 4: Write a program to determine if a person is eligible for a driving license based on their age and whether they have passed the driving test. The program should follow these steps:

- Prompt the user to enter their age.
- Validate that the entered age is a positive number.
- If the age is 18 or older, check if the person has passed the driving test.
- If the person is 18 or older and has passed the driving test, they are eligible for a driving license.
- If the person is not eligible for a driving license (either under 18 or has not passed the driving test), display a message accordingly.
- If the age entered is not valid (e.g., negative number), display an error message.