Lab 2 — Control Structures in C++

🎯 Objectives

By the end of this lab, you will be able to:

✅ Use **relational and logical operators**.

✅ Apply **if**, **if...else**, and **nested if** statements.

✅ Use the **switch** statement.

✅ Understand **short-circuit evaluation**.

✅ Build a complete program using **selection structures**.

◆ Part 1 — Relational and Logical Operators

❓ Question 1

Write a program that uses **relational operators** to compare two integers and print the results.

✅ Answer

```cpp
#include <iostream>
using namespace std;

int main() {
    int a = 8, b = 15;
    cout << (a < b) << endl;    // true → 1
    cout << (a == b) << endl;   // false → 0
    cout << (a != b) << endl;   // true → 1
    return 0;
}
```

❓ Question 2

Use **logical operators** to test whether two conditions are both true.

✅ Answer

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 5, y = 10;
    bool result = (x < y) && (y > 0);
    cout << result;   // true → 1
    return 0;
}
```

❓ Question 3

Ask the user for two numbers and print:

- whether the first is greater than the second, and
- whether both numbers are positive.

✅ Answer

```cpp
#include <iostream>
using namespace std;

int main() {
    int n1, n2;
    cout << "Enter two numbers: ";
    cin >> n1 >> n2;

    cout << "Is first > second? " << (n1 > n2) << endl;
    cout << "Are both positive? " << (n1 > 0 && n2 > 0) << endl;
    return 0;
}
```

◆ Part 2 — Using if and if...else

❓ Question 4

Write a one-way selection program that prints "Eligible to vote" only if the user's age is 18 or more.

✅ Answer

```cpp
#include <iostream>
using namespace std;

int main() {
    int age;
    cout << "Enter your age: ";
    cin >> age;

    if (age >= 18)
        cout << "Eligible to vote.\n";
}
```

❓ Question 5

Write a two-way selection program that prints

- "Excellent!" if the grade is **A**,
- otherwise "Keep trying!"

✅ Answer

```cpp
#include <iostream>
using namespace std;

int main() {
    char grade;
    cout << "Enter your grade (A-F): ";
    cin >> grade;

    if (grade == 'A')
        cout << "Excellent!" << endl;
    else
        cout << "Keep trying!" << endl;
}
```

◆ **Part 3 — Nested if**

❓ **Question 6**

Write a program that asks for a score and prints both a letter grade and a message.

✅ **Answer**

```cpp
#include <iostream>
using namespace std;

int main() {
    int score;
    cout << "Enter your score: ";
    cin >> score;

    if (score >= 90)
        cout << "Grade: A - Great job!\n";
    else if (score >= 80)
        cout << "Grade: B - Great job!\n";
    else if (score >= 70)
        cout << "Grade: C - Good effort!\n";
    else
        cout << "Grade: F - Needs improvement!\n";
}
```

◆ **Part 4 — Short-Circuit Evaluation**

❓ **Question 7**

Why doesn't this expression cause an error?
(x != 0 && (10 / x) > 1)

✅ **Answer (Code + Explanation)**

```cpp
#include <iostream>
using namespace std;

int main() {
    int x = 0;
    if (x != 0 && (10 / x) > 1)
        cout << "Valid";
    else
        cout << "Invalid";
}
```

🧠 Explanation:

Because of **short-circuit evaluation**, the second condition (10 / x) > 1 is never checked when x != 0 is false, so no division by zero occurs.

◆ **Part 5 — Switch Statement**

❓ **Question 8**

Write a program using a switch statement that prints the month name for numbers 1–4.

✅ **Answer**

```cpp
#include <iostream>
using namespace std;

int main() {
    int month;
    cout << "Enter month number (1-4): ";
    cin >> month;

    switch (month) {
        case 1: cout << "January"; break;
        case 2: cout << "February"; break;
        case 3: cout << "March"; break;
        case 4: cout << "April"; break;
        default: cout << "Invalid month";
    }
}
```