Computer Programming (a)

E1123

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Lecture 5

Conditions & Quiz

INSTRUCTOR

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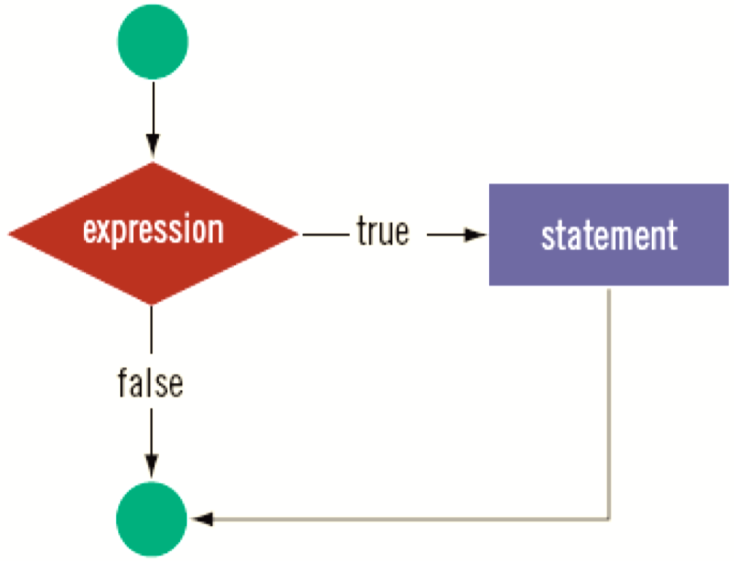
Conditions

- One-Way
- Two-Way
- Multiple - Nested

➢ One-Way Selection

The syntax of one-way selection is:

```
If ( expression )
   statement
```



- ❑ The statement is executed if the value of the expression is true
- ❑ The statement is bypassed if the value is false; program goes to the next statement
- ❑ if is a reserved word

➢ One-Way Selection (syntax error)

Consider the following statement:

```
if score >= 60      //syntax error
   grade = 'P';
```

This statement illustrates an incorrect version of an `if` statement. The parentheses around the logical expression are missing, which is a syntax error.

Consider the following C++ statements:

```
if (score >= 60);          //Line 1
    grade = 'P';           //Line 2
```

Because there is a semicolon at the end of the expression (see Line 1), the `if` statement in Line 1 terminates. The action of this `if` statement is null, and the statement in Line 2 is not part of the `if` statement in Line 1. Hence, the statement in Line 2 executes regardless of how the `if` statement evaluates.

➢ Example

The following C++ program finds the absolute value of an integer:

```
//Program: Absolute value of an integer

#include <iostream>

using namespace std;

int main()
{
    int number, temp;

    cout << "Line 1: Enter an integer: ";          //Line 1
    cin >> number;                                 //Line 2
    cout << endl;                                  //Line 3

    temp = number;                                 //Line 4

    if (number < 0)                                //Line 5
        number = -number;                          //Line 6

    cout << "Line 7: The absolute value of "
         << temp << " is " << number << endl;      //Line 7

    return 0;
}
```

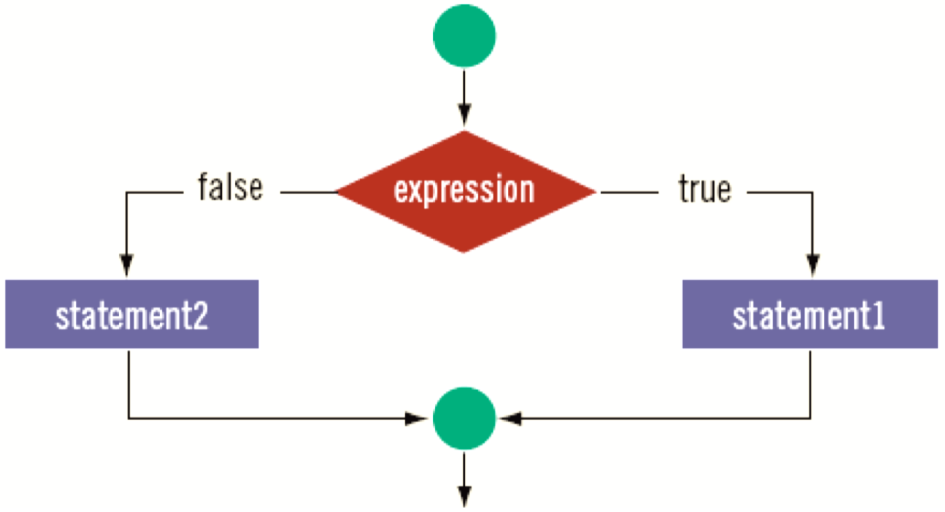
Sample Run: In this sample run, the user input is shaded.

```
Line 1: Enter an integer: -6734
Line 7: The absolute value of -6734 is 6734
```

➢ Two-Way Selection

Two-way selection takes the form:

```
If ( expression )
    statement1
else
    statement2
```



- If expression is true, statement1 is executed; otherwise, statement2 is executed
  - statement1 and statement2 are any C++ statements
- else is a reserved word

Example→ Consider the following statements:

```
if (hours > 40.0)                                   //Line 1
    wages = 40.0 * rate +
            1.5 * rate * (hours - 40.0);            //Line 2
else                                                //Line 3
    wages = hours * rate;                           //Line 4
```

➢ Compound (Block of) Statement

Compound statement (block of statements):

```
{
    statement1
    statement2
       .
       .
       .
    statementn
}
```

➢ Multiple Selections: Nested if

- Nesting: one control statement in another
- An else is associated with the most recent if that has not been paired with an else

Suppose that balance and interestRate are variables of type double. The following statements determine the interestRate depending on the value of the balance:

```
if (balance > 50000.00)                  //Line 1
    interestRate = 0.07;                 //Line 2
else                                     //Line 3
    if (balance >= 25000.00)             //Line 4
        interestRate = 0.05;             //Line 5
    else                                 //Line 6
        if (balance >= 1000.00)          //Line 7
            interestRate = 0.03;         //Line 8
        else                             //Line 9
            interestRate = 0.00;         //Line 10
```

most efficient method

```
if (balance > 50000.00)
    interestRate = 0.07;
else if (balance >= 25000.00)
    interestRate = 0.05;
else if (balance >= 1000.00)
    interestRate = 0.03;
else
    interestRate = 0.00;
```

➢ Example

Assume that score is a variable of type int. based on the value of score, the following code outputs the grade:

```
if (score >= 90)
      cout << "The grade is A." << endl;
else if (score >= 80)
      cout << "The grade is B." << endl;
else if (score >= 70)
      cout << "The grade is C." << endl;
else if (score >= 60)
      cout << "The grade is D." << endl;
else
      cout << "The grade is F." << endl;
```

➢ Comparing if…else Statements with a Series of if Statements

First method

```
if (month == 1)
    cout << "January" << endl;
if (month == 2)
    cout << "February" << endl;
if (month == 3)
    cout << "March" << endl;
if (month == 4)
    cout << "April" << endl;
if (month == 5)
    cout << "May" << endl;
if (month == 6)
    cout << "June" << endl;
```

Second method

```
if (month == 1)
    cout << "January" << endl;
else if (month == 2)
    cout << "February" << endl;
else if (month == 3)
    cout << "March" << endl;
else if (month == 4)
    cout << "April" << endl;
else if (month == 5)
    cout << "May" << endl;
else if (month == 6)
    cout << "June" << endl;
```

➢ **Which method is preferred?**

➢ Associativity of Relational Operators:

```
#include <iostream>

using namespace std;

int main()
{
     int num;

     cout << "Enter an integer: ";
     cin >> num;
     cout << endl;

     if (0 <= num <= 10)
          cout << num << " is within 0 and 10." << endl;
     else
          cout << num << " is not within 0 and 10." << endl;

     return 0;
}
```

Solution:

Sample Runs:

Sample Run 1:

Enter an integer: 5

5 is within 0 and 10. (correct)

Sample Run 2:

Enter an integer: 20

20 is within 0 and 10. (incorrect)

Sample Run 3:

Enter an integer: -10

-10 is within 0 and 10. (incorrect)

`0 <= num <= 10`	`= 0 <= 5 <= 10`	
	`= (0 <= 5) <= 10`	(Because relational operators are evaluated from left to right)
	`= 1 <= 10`	(Because `0 <= 5` is `true`, `0 <= 5` evaluates to 1)
	`= 1 (true)`	

Now, suppose that `num = 20`. Then:

`0 <= num <= 10`	`= 0 <= 20 <= 10`	
	`= (0 <= 20) <= 10`	(Because relational operators are evaluated from left to right)
	`= 1 <= 10`	(Because `0 <= 20` is `true`, `0 <= 20` evaluates to 1)
	`= 1 (true)`	

(0 <= num && num <= 10)

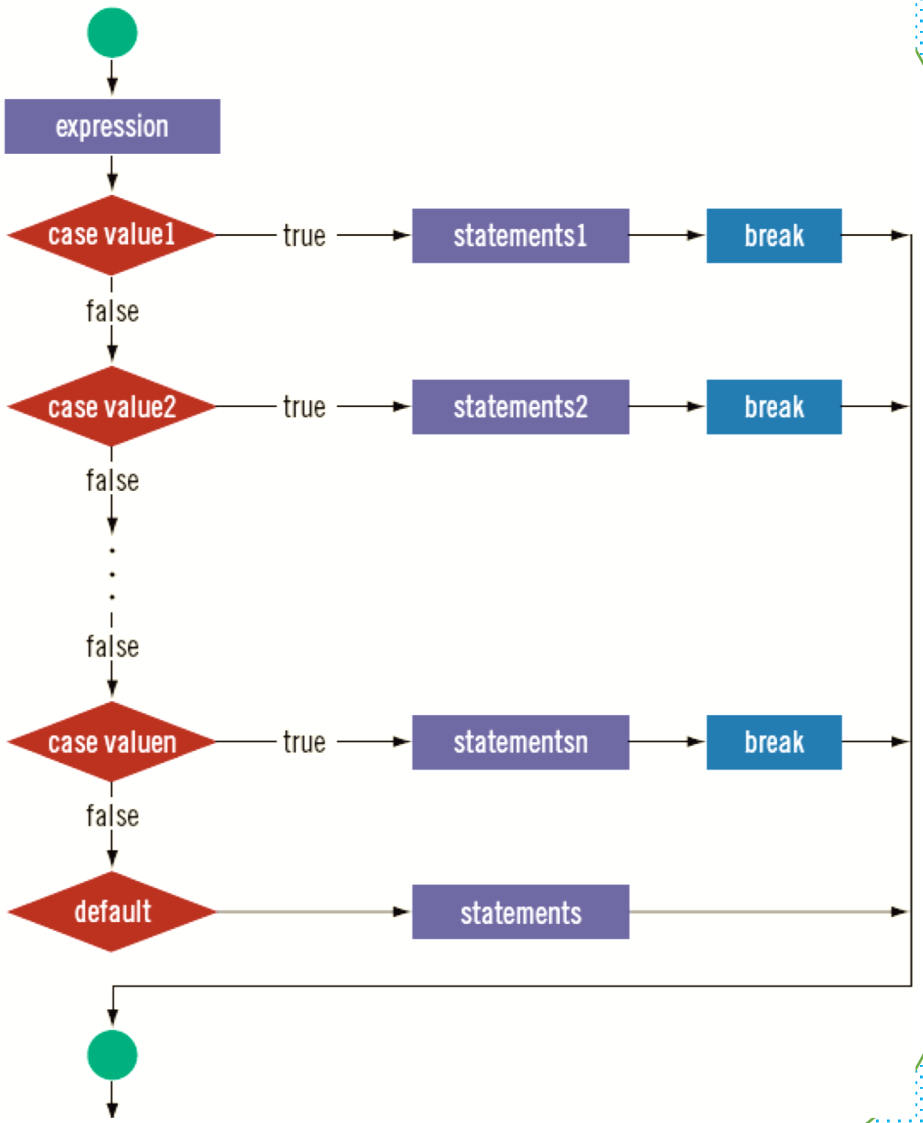
➢ switch Structures

- switch structure: alternate to if-else
- switch (integral) expression is evaluated first
- Value of the expression determines which corresponding action is taken
- Expression is sometimes called the selector

```
switch (expression)
{
case value1:
    statements1
    break;
case value2:
    statements2
    break;
    .
    .
    .
case valuen:
    statementsn
    break;
default:
    statements
}
```

➢ switch Structures (cont.)

- One or more statements may follow a case label
- Braces are not needed to turn multiple statements into a single compound statement
- The break statement may or may not appear after each statement
- switch, case, break, and default are reserved words



➢ Example

Consider the following statements, where grade is a variable of type **char**:

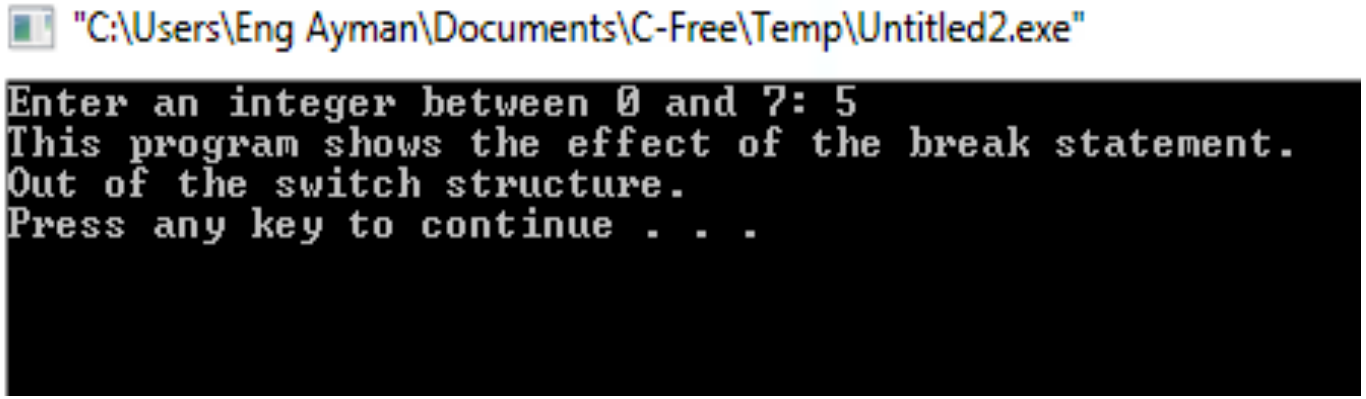
```
switch (grade)
{
case 'A':
    cout << "The grade is 4.0.";
    break;
case 'B':
    cout << "The grade is 3.0.";
    break;
case 'C':
    cout << "The grade is 2.0.";
    break;
case 'D':
    cout << "The grade is 1.0.";
    break;
case 'F':
    cout << "The grade is 0.0.";
    break;
default:
    cout << "The grade is invalid.";
}
```

In this example, the expression in the **switch** statement is a variable identifier. The variable **grade** is of type **char**, which is an integral type. The possible values of **grade** are **'A'**, **'B'**, **'C'**, **'D'**, and **'F'**. Each **case** label specifies a different action to take, depending on the value of **grade**. If the value of **grade** is **'A'**, the output is:

```
The grade is 4.0.
```

➢ Example (attention)

```
int main()
{                   int num;
                        cout << "Enter an integer between 0 and 7: ";
                        cin >> num;
                switch(num)
                        {
                        case 0:
                        case 1:
                        cout << "Learning to use ";
                        case 2:
                        cout << "C++'s ";
                        case 3:
                        cout << "switch structure." << endl;
                        break;
                        case 4:
                        break;
                        case 5:
                        cout << "This program shows the effect ";
                        case 6:
                        case 7:
                        cout << "of the break statement." << endl;
                        break;
                        default:
                        cout << "The number is out of range." << endl;
                        }
                cout << "Out of the switch structure." << endl;
                return 0;
                }
```



Quiz

➢ Quiz

- Write a C++ program that ask the user to enter a number with any value. The program then checks the value of the entered number if the value is in between 0 and 100 (both included) the program prints "in range" otherwise the program prints "out of range".

Thank you