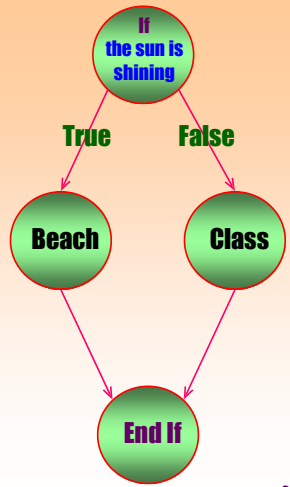
# Programming in C++

## Choice Statements

## If Statements

```
if (the sun is shining)
    go to the beach;
else
    go to class;
```

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# Boolean Data Type (false, true)

i.e.

```
bool bFlag;                    bFlag
bFlag = true;                  true
bFlag = 5 > 12;                false
bFlag = 4 == 3 + 1;            true
```

Assignment Statement

Boolean Operator

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# Boolean Data-Type

- The type bool is also described as being an integer:
  - false = 0
  - true = 1

```
bool b = 1;
cout << b;
```
Output: 1

```
bool b = false;
cout << b;
```
Output: 0

```
int x = 42;
cout << x + true;
```
Output: 43

```
bool b = true;
cout << b;
```
Output: 1

```
int x = 42;
bool b = true;
cout<< x + b;
```
Output: 43

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# Boolean Operators

## Binary Operators – Compare two values

| Mathematics | C++ |
|---|---|
| = | == |
| ≠ | != |
| > | > |
| ≥ | >= |
| < | < |
| ≤ | <= |

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# Order of Operations

1. Brackets
2. Prefix operators ( `++var` , `--var`, `-exp`, `+exp` )
3. Multiplication ( `*` ) and Division ( `/` ) and Remainder ( `%` )
4. Addition ( `+` ) and Subtraction ( `–` )
5. Comparison ( `>` , `>=` , `<` , `<=` )
6. Equality ( `==` , `!=` )
7. Assignment Statement ( `=` )
8. Postfix operators ( `var++` , `var--` )

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## Exercises

```
4 == 2 + 3 - 1                  true
5 + 2 != 7 - 2                  true
9 + 2 * 4 / 5 >= 12             false
5 + 19 % 7 / 2 * 3 != 11        false
```

**What is wrong with the followings?**

```
1 + [6 + 3 * (6 - 2)]

((5 + 1 * 2) + 3) * 2
```



## Operators ( Or , And , Not )

```
Age = 30;
10 < Age < 20 Î  true
   true
    1
```

false = 0
true = 1

```
(10 < Age) && (Age < 20)    false
```

## Logical Conditions ( Or, And , Not )

**OR**

true || true = true
true || false = true
false || true = true
false || false = false

**AND**

true && true = true
true && false = false
false && true = false
false && false = false

**NOT**

! true = false
! false = true

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## Order of Operations

1. Brackets
2. Prefix operators ( `++var` , `--var`, `-exp`, `+exp` )
3. Multiplication ( * ) and Division ( / ) and Remainder ( % )
4. Addition ( + ) and Subtraction ( – )
5. Comparison ( `>` , `>=` , `<` , `<=` )
6. Equality ( `==` , `!=` )
7. Logical AND ( `&&` )
8. Logical OR ( `||` )
9. Assignment Statement ( = )
10. Postfix operators ( `var++` , `var--` )

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# Exercises

**Note:**

- **false = 0**
- **true = not zero**

**Exercises:**

| Statement | Output |
|---|---|
| cout << true \|\| false && false; | 1 |
| cout << (true \|\| false) && false; | 0 |
| cout << true && 7; | 1 |
| cout << 12 && 0; | 0 |
| cout << 7 > 5; | Error - needs () |
| cout << (7 > 5); | 1 |

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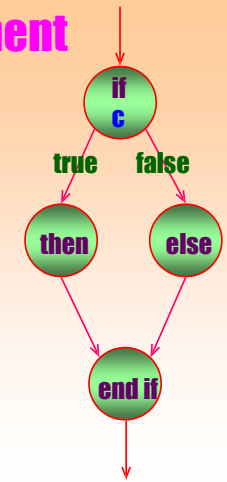
# if-then-else statement

```
if (<Condition>)
    <Statement>;
else
    <Statement>;
```

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## if-then-else Example

```
int Num1;
int Num2;

 cin >> Num1 >> Num2;
 if (Num1 > Num2)
    cout << Num1;
 else
    cout << Num2;
```

| Num1 | Num2 | Output |
|---|---|---|
| 7 | 5 | 7 |
| 3 | 9 | 9 |
| 7 | 7 | 7 |

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## Another example

```
int grade;
 cout << "Enter your grade: ";
 cin >> grade;
 if (grade >= 60)
    cout << "You passed";
 else
    cout << "You failed";
```

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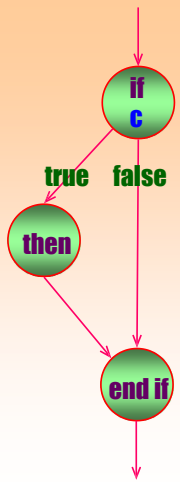
## if-then Statement

```
if (<Condition>)
    <Statement>;
```

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## if-then Example

```
int grade;
cout << "Enter your grade: ";
cin >> grade;
if (grade >= 60)
   cout << "You passed";
```

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## Compound Statements

```
int grade = 30;
if (grade >= 60)
{
   cout << "You passed" << endl;
   cout << "Congratulations";
}
```

```
{
int grade = 30;
if (grade >= 60)
   cout << "You passed" << endl;
   cout << "Congratulations";
}
```

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## Compound Statements

```
int grade;
cout << "Enter your Grade: ";
cin >> grade;
if (grade >= 60)
{
  cout << "You passed" << endl;
  cout << "Congratulations\n";
}
else
{
  cout << "You failed" << endl;
  cout << "SORRY\n";
}
```

Enter your grade: **82**
You passed
Congratulations

Enter your grade: **46**
You failed
SORRY

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## Error. Why?

```
int grade;
cout << "Enter your Grade: ";
cin >> grade;
if (grade >= 60)

   cout << "You passed" << endl;
   cout << "Congratulations\n";

else

   cout << "You failed" << endl;
   cout << "SORRY\n";
```

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## Correct but . . .

```
int grade;
cout << "Enter your Grade: ";
cin >> grade;
if (grade >= 60)
{
   cout << "You passed" << endl;
   cout << "Congratulations\n";
}
else

   cout << "You failed" << endl;
   cout << "SORRY\n";
```

Enter your grade: **46**
You failed
SORRY

Enter your grade: **82**
You passed
Congratulations
SORRY

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# Nested if-Statements

```
int Num1, Num2;
cin >> Num1 >> Num2;
if (Num1 > Num2)
   if (Num1 + Num2 > 20)
      cout << Num1;
   else
      cout << Num2;
```

| Num1 | Num2 | Output |
|---|---|---|
| 5 | 10 | |
| 12 | 3 | 3 |
| 12 | 10 | 12 |

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# Same as previous example ?

```
int Num1, Num2;
cin >> Num1 >> Num2;
if (Num1 > Num2)
{
   if (Num1 + Num2 > 20)
      cout << Num1;
}
   else
      cout << Num2;
```

| Num1 | Num2 | Output |
|---|---|---|
| 5 | 10 | 10 |
| 12 | 3 | |
| 12 | 10 | 12 |

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## Example

```
int grade;

cout << "Enter your grade: ";
cin >> grade;

if (grade > 100 || grade < 0)
  cout << "Not a valid grade";
else {
  cout << "You got ";
  if (grade >= 90) cout << "an A";
  else if (grade >= 80) cout << "a B";
  else if (grade >= 70) cout << "a C";
  else if (grade >= 60) cout << "a D";
  else cout << "an F";
}
```

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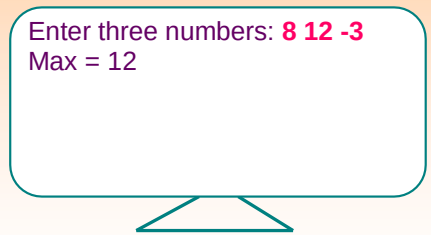
## Programming Exercise

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## Solution 1

Enter three numbers: 8 4 -3
Max = 8

```
int a, b, c;
cout << "Enter three numbers: ";
cin >> a >> b >> c;

if (a > b)
   if (a > c)
      cout << "Max = " << a;
   else
      cout << "Max = " << c;
else
   if (b > c)
      cout << "Max = " << b;
   else
      cout << "Max = " << c;
```

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## Solution 2

Enter three numbers: -8 4 -3
Max = 4

```
int a, b, c, max;
cout << "Enter three numbers: ";
cin >> a >> b >> c;

if (a > b)
   max = a;
else
   max = b;

if (c > max)
   max = c;

cout << "Max = " << max;
```

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## Solution 3

Enter three numbers: 4 32 45
Max = 45

```
int a, b, c;
cout << "Enter three numbers: ";
cin >> a >> b >> c;
if (a >= b && a >= c)
  cout << "Max = " << a;
else if (b >= a && b >= c)
  cout << "Max = " << b;
else
  cout << "Max = " << c;
```

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## Programming Exercise

How old are you? 18
You are a teenager

| Age | |
|---|---|
| 0 – 4 | Baby |
| 5 – 14 | Child |
| 15 – 19 | Teenager |
| 20 – 64 | Adult |
| above 64 | Old |

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## Solution

How old are you? **32**
You are an adult

```
int Age;

cout << "How old are you? ";
cin >> Age;
cout << "You are ";

if (Age < 0)
  cout << "not born yet";
else if (Age < 5)
  cout << "a baby";
else if (Age < 15)
  cout << "a child";
else if (Age < 20)
  cout << "a teenager";
else if (Age < 65)
  cout << "an adult";
else
  cout << "old";
```

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## Exercise

Enter a digit: **3**
Three

```
int Digit;
cout << "Enter a digit: ";
cin >> Digit;
if (Digit == 0)
  cout << "Zero";
else if (Digit == 1)
  cout << "One";
else if (Digit == 2)
  cout << "Two";
else if (Digit == 3)
  cout << "Three";
else if (Digit == 4)
  cout << "Four";
else if (Digit == 5)
  cout << "Five";
else if (Digit == 6)
  cout << "Six";
else if (Digit == 7)
  cout << "Seven";
else if (Digit == 8)
  cout << "Eight";
else if (Digit == 9)
  cout << "Nine";
else
  cout << "Not a digit";
```

# What's wrong with this?

```
Day = 4;
if (Day = 0)
   cout << "Sunday";
else if (Day = 1)
   cout << "Monday";
else if (Day = 2)
   cout << "Tuesday";
else if (Day = 3)
   cout << "Wednesday";
else if (Day = 4)
   cout << "Thursday";
else if (Day = 5)
   cout << "Friday";
else if (Day = 6)
   cout << "Saturday";
```


```
if (Day == 0)
   cout << "Sunday";
```

same as

```
if (0 == Day)
   cout << "Sunday";
```

but the following will give a syntax error

```
if (0 = Day)
   cout << "Sunday";
```



```
bool Flag;
if (Flag == true)
   . . .
```

```
bool Flag;
if (Flag)
   . . .
```

Same

**Note:**

`false` = 0
`true` ≠ 0

```
int num = 10
if (num)
   . . .
```

true

```
if (1)
   . . .
```

true

```
if (true)
   . . .
```

true

```
if (3-2-1)
   . . .
```

false

```
if (2.344)
   . . .
```

true

# Nesting

- The Condition is the most right

```
if (x = Grade/100, x >= 0.6)
{
  cout << "You passed" << endl;
  cout << "Congratulations";
}
```

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# Be Careful

```
Grade = 30;
if (Grade >= 60) ;
{
  cout << "You passed\n";
  cout << "Congratulations\n";
}
```

You passed
Congratulations

```
Grade = 74;
if (Grade >= 60)
{
  cout << "You passed" << endl;
  cout << "Congratulations\n";
}
else ;
{
  cout << "You failed\n";
  cout << "SORRY\n";

}
```

You passed
Congratulations
You failed
SORRY

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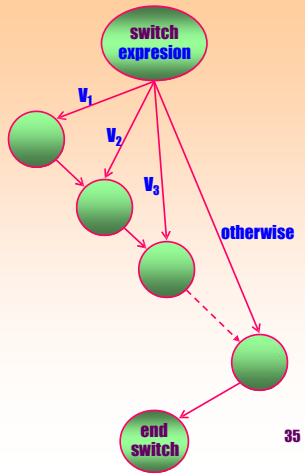
## Switch (Case) Statement

```
switch (<expression>) {
   case V1 : <Statements>;
   case V2 : <Statements>;
   case V3 : <Statements>;
    . . .
   default : <Statements>;
}
```

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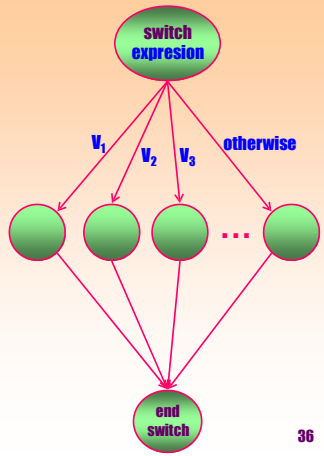
## Switch Statement with break

```
switch (<expression>) {
   case V1 : <Statements>;
             break;
   case V2 : <Statements>;
             break;
   case V3 : <Statements>;
             break;
    . . .
   default : <Statements>;
             break;
}
```

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# Break Statement

- The break statement causes execution to exit the switch statement. Otherwise, the flow of control "falls through" the next case.

```
switch (Grade)
{
  case 'A' :
  case 'B' :
  case 'C' :
  case 'D' :
    cout << "You passed"; break;
  case 'F' :
    cout << "You failed"; break;
  default :
    cout << "Invalid grade"; break;
}
```

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# Switch Statement Example

```
int Digit;
cout << "Enter a digit: ";
cin >> Digit;
switch (Digit) {
  case 0: cout << "Zero"; break;
  case 1: cout << "One"; break;
  case 2: cout << "Two"; break;
  case 3: cout << "Three"; break;
  case 4: cout << "Four"; break;
  case 5: cout << "Five"; break;
  case 6: cout << "Six"; break;
  case 7: cout << "Seven"; break;
  case 8: cout << "Eight"; break;
  case 9: cout << "Nine"; break;
  default: cout << "Not a digit"; break;
}
```

Enter a digit: 3
Three

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# Programming Exercise

How old are you? 18
You are a teenager

| Age | |
|---|---|
| 0 – 4 | Baby |
| 5 – 14 | Child |
| 15 – 19 | Teenager |
| 20 – 64 | Adult |
| above 64 | Old |

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## Solution

How old are you? 32
You are an adult

```
int Age;
cout << "How old are you? ";
cin >> Age;
cout << "You are ";
if (Age < 0)
  cout << "not born yet";
else
  switch (Age / 5) {
    case 0 : cout << "a baby"; break;
    case 1 :
    case 2 : cout << "a child"; break;
    case 3 : cout << "a teenager"; break;
    case 4 :
    case 5 :
    case 6 :
    case 7 :
    case 8 :
    case 9 :
    case 10 :
    case 11 :
    case 12 : cout << "an adult"; break;
    default : cout << "old"; break;
  }
```

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# The Conditional Statement

**A shortcut to a simple if-then-else statement used normally to assign different values to a variable depending on a condition.**

```
condition ? stment_if_true : stment_if_false
```

```
if(year%4 == 0) FebDays = 29;
else FebDays = 28;
```

**same as**

```
FebDays = year%4 == 0 ? 29 : 28;
```

**same as**

```
year%4 == 0 ? FebDays = 29 : FebDays = 28;
```

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