# The `if-else` Statement

- Selects between two statements based on the results of a comparison
- General form:

```
if (expression) statement1;
     else statement2;
```

  - If the value of `expression` is true, `statement1` is executed
  - If the value is false, `statement2` is executed

## Program 4.1

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

int main()
{
  double taxable, taxes;

  cout << "Please type in the taxable income: ";
  cin  >> taxable;

  if (taxable <= 20000.0)
    taxes = 0.02 * taxable;
  else
    taxes = 0.025 * (taxable - 20000.0) + 400.0;

  cout << setiosflags(ios::fixed)
       << setiosflags(ios::showpoint)
       << setprecision(2)
       << "Taxes are $ " << taxes << endl;

  return 0;
}
```

# The `if-else` Statement (cont'd.)

- Program 4.1 run twice with different input data
  - Result 1:

```
Please type in the taxable income: 10000
Taxes are $ 200.00
```

  - Result 2:

```
Please type in the taxable income:  30000
Taxes are $ 650.00
```

# Compound Statements

- Sequence of single statements between braces

```
if (expression)
{
  statement1;    // as many statements as necessary
  statement2;    // can be put inside the braces
  statement3;    // each statement must end with a ;
}
else
{
  statement4;
  statement5;
      .
      .
  last statement;
}
```

## Program 4.2

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

// a temperature conversion program
int main()
{
  char tempType;
  double temp, fahren, celsius;

  cout << "Enter the temperature to be converted: ";
  cin  >> temp;
  cout << "Enter an f if the temperature is in Fahrenheit";
  cout << "\n or a c if the temperature is in Celsius: ";
  cin  >> tempType;

  // set output formats
  cout << setiosflags (ios::fixed)
       << setiosflags (ios::showpoint)
       << setprecision(2);

  if (tempType == 'f')
  {
    celsius = (5.0 / 9.0) * (temp - 32.0);
    cout << "\nThe equivalent Celsius temperature is "
         << celsius << endl;
  }
  else
  {
    fahren = (9.0 / 5.0) * temp + 32.0;
    cout << "\nThe equivalent Fahrenheit temperature is "
         << fahren << endl;
  }

  return 0;
}
```

# Compound Statements (cont'd.)

- Output of Program 4.2

```
Enter the temperature to be converted: 212
Enter an f if the temperature is in Fahrenheit
or a c if the temperature is in Celsius: f

The equivalent Celsius temperature is 100.00
```

# Block Scope

- Block of code: all statements contained within a compound statement
- Any variable declared within a block has meaning only between its declaration and the closing braces of the block
- Example with two blocks of code

# Block Scope (cont'd.)

```
{   // start of outer block
    int a = 25;
    int b = 17;
    cout << "The value of a is " << a << " and b is " <<
b << endl;
    {  // start of inner block
                    double a = 46.25;
                    int c = 10;
                    cout << "a is now " << a
                            << " b is now " << b
                            << " and c is " << c << endl;
    }               // end of inner block
    cout << "a is now " << a << " and b is " << b <<
    endl;
 }    // end of outer block
```

# Block Scope (cont'd.)

- Output of block scope example:

```
The value of a is 25 and b is 17
a is now 46.25 b is now 17 and c is 10
a is now 25 and b is 17
```

# One-Way Selection

- A modification of `if-else` that omits else part
  - `if` statement takes the form:

```
if (expression)
   statememt;
```

- Modified form called a one-way statement
  - The statement following `if (expression)` is executed only if the expression is true
  - The statement may be a compound statement

# One-Way Selection (cont'd.)

Program 4.3

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

int main()
{

  const double LIMIT = 3000.0;
  int idNum;
  double miles;

  cout << "Please type in car number and mileage: ";
  cin  >> idNum >> miles;

  if(miles > LIMIT)
    cout << " Car " << idNum << " is over the limit." << endl;

  cout << "End of program output." << endl;

  return 0;
}
```

# One-Way Selection (cont'd.)

- Program 4.3 run twice with different input data
  - Result 1:

```
Please type in car number and mileage: 256  3562.8
   Car 256 is over the limit.
End of program output.
```

  - Result 2:

```
Please type in car number and mileage: 23  2562.8
End of program output.
```

# Problems Associated with the `if-else` Statement

- Most common problems:
  - Misunderstanding what an expression is
  - Using the assignment operator, `=`, in place of the relational operator, `==`
- Example:
  - Initialize `age = 18`
  - The expression (`age = 40`) sets `age` to 40
    - Does not compare age to 40
    - Has a value of 40 (true)
    - Produces invalid results if used in `if-else` statement

# Problems Associated with the `if-else` Statement (cont'd.)

- Example (cont'd.):
  - The expression (`age == 40`) compares `age` to 40
    - Has a value of 0 (false)
  - This expression will produce a valid test in an `if-else` statement