

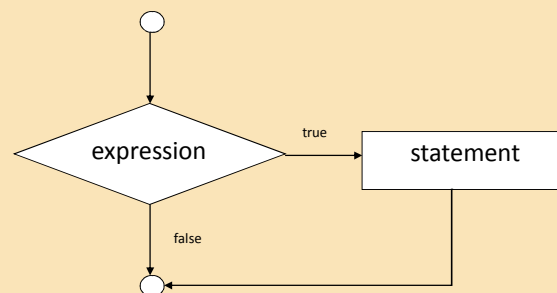


## Control Structure: Selection

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### One-Way Selection



- General Format:

```
if (expression)
    statement;
```

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## if statement – what happens

To evaluate:

```
if (expression)  
    statement;
```

- If the *expression* is true, then *statement* is executed.
- If the *expression* is false, then *statement* is skipped.

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## From pseudo code to C++ code

1. Start
2. Read n
3. If ( $n \% 2 == 0$ )
  - 3.1 Print "This is an even number"
4. End if
5. End

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## From pseudo code to C++ code

1. Start
2. Read n
3. If ( $n \% 2 == 0$ )
  - 3.1 Print n
  - 3.2 Print "This is an even number"
4. End if
5. End

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```
#include <iostream>
#include<iomanip>
using namespace std;
int main()
{ int score1, score2;
  double avg;

  cin>>score1>>score2;
  avg=(score1+score2)/2;
  cout<<fixed<<showpoint<<setprecision(2);
  cout<<avg<<endl;
  if(avg>95)
    cout<<"Congrats! High Score"<<endl;

  system("PAUSE");
  return 0;
}
```

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```

#include <iostream>
#include<iomanip>
using namespace std;
int main()
{ int score1, score2;
  double avg;

  cin>>score1>>score2;
  avg=(score1+score2)/2;
  cout<<fixed<<showpoint<<setprecision(2);
  cout<<avg<<endl;
  if(avg>95)
    cout<<"Congrats!"<<endl;
  cout<<"High Score"<<endl;

  system("PAUSE");
  return 0;
}

```



## if statement notes

- Do not place ; after (*expression*)
- Place *statement*; on a separate line after (*expression*), indented:  

```

if (score > 90)
    grade = 'A';

```
- Be careful testing floats and doubles for equality
- 0 is false; any other value is true



## Flags

- Variable that signals a condition
- Usually implemented as a `bool` variable
- As with other variables in functions, must be assigned an initial value before it is used

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## Example

- Trace the following programs if the input is 22 and 68

```
int main()
{
    double mark;
    bool pass=false; //this condition does not yet exist

    cout<<"Enter your mark>>";
    cin>>mark;

    if (mark >=30)
        pass=true;
    if (pass)
        cout<<"You pass the test"<<endl;
    if (!pass)
        cout<<"You fail the test"<<endl;
    cout<<"Program end";

    return 0;
}
```

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## Expanding the `if` Statement

- To execute more than one statement as part of an `if` statement, enclose them in `{ }`:

```
if (score > 90)
{
    grade = 'A';
    cout << "Good Job!\n";
}
```

- `{ }` creates a **block** of code

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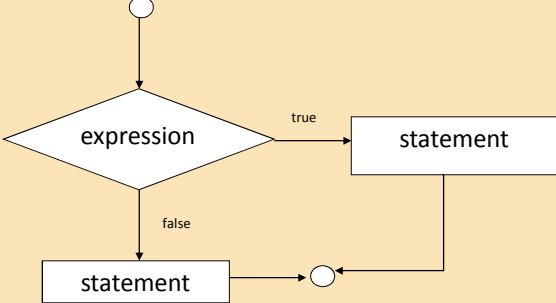


## Two-Way Selection

- Provides two possible paths of execution
- Performs one statement or block if the *expression* is true, otherwise performs another statement or block.

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 **The if/else Statement**



```

graph TD
    Start(( )) --> Expression{expression}
    Expression -- true --> Statement1[statement]
    Expression -- false --> Statement2[statement]
    Statement1 --> End(( ))
    Statement2 --> End
  
```

- General Format:
 

```

      if (expression)
          statement1; // or block
      else
          statement2; // or block
      
```

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 **if/else – what happens**

To evaluate:

```

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

- If the *expression* is true, then *statement1* is executed and *statement2* is skipped.
- If the *expression* is false, then *statement1* is skipped and *statement2* is executed.

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**Program 4-8**

```

1 // This program uses the modulus operator to determine
2 // if a number is odd or even. If the number is evenly divisible
3 // by 2, it is an even number. A remainder indicates it is odd.
4 #include <iostream>
5 using namespace std;
6
7 int main()
8 {
9     int number;
10
11     cout << "Enter an integer and I will tell you if it\n";
12     cout << "is odd or even. ";
13     cin >> number;
14     if (number % 2 == 0)
15         cout << number << " is even.\n";
16     else
17         cout << number << " is odd.\n";
18     return 0;
19 }

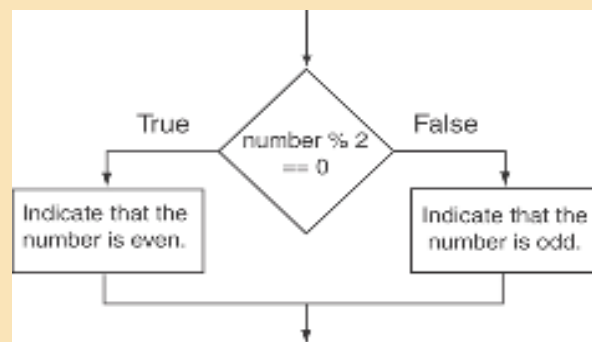
```

**Program Output with Example Input Shown in Bold**

Enter an integer and I will tell you if it  
is odd or even. **17 [Enter]**  
17 is odd.



## Flowchart





## From pseudo code to C++ code

1. Start
2. Read n
3. If n modulus 2 = 0
  - 3.1 Print n
  - 3.2 Print "This is an even number"
4. Else
  - 4.1 Print n
  - 4.2 Print "This is an odd number"
5. End if
6. End

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```
#include <iostream>
#include<iomanip>
using namespace std;
int main()
{ int score1, score2;
  double avg;

  cin>>score1>>score2;
  avg=(score1+score2)/2;
  cout<<fixed<<showpoint<<setprecision(2);
  cout<<avg<<endl;
  if(avg>95)
    cout<<"High Score"<<endl;
  else
    cout<<"Average score"<<endl;

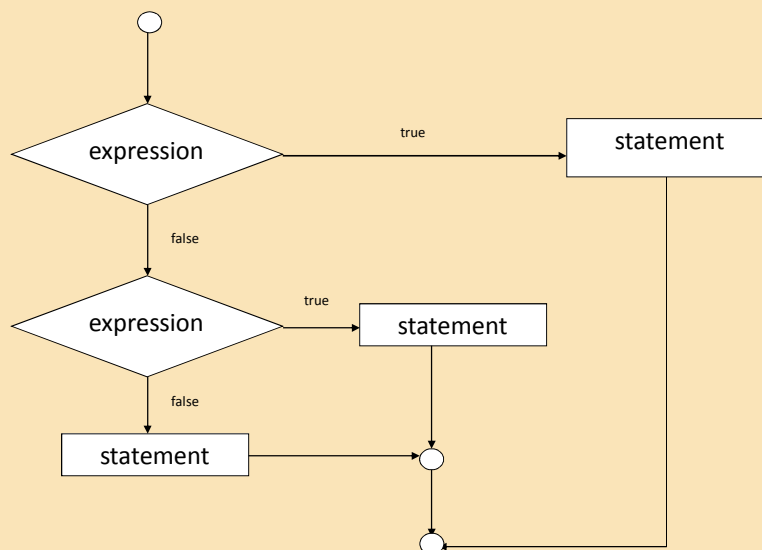
  system("PAUSE");
  return 0;}
```



## The `if/else if` Statement

- Chain of `if` statements that test in order until one is found to be true
- Also models thought processes:
  - “If it is raining, take an umbrella, else, if it is windy, take a hat, else, take sunglasses”

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## if/else if format

```

if (expression)
    statement1; // or block
else if (expression)
    statement2; // or block
.
. // other else ifs
.
else if (expression)
    statementn; // or block
else
    statementn; // or block

```

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## From pseudo code to C++ code

1. Start
2. Read decibels
3. If (decibels <= 30)
  - 3.1 print "Quiet"
4. Else if(decibels >=51 && decibels <=70)
  - 4.1 print "annoying"
5. Else
  - 5.1 print "very annoying"
6. End if
7. end

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**Program 4-10**

```

1  // This program uses an if/else if statement to assign a
2  // letter grade (A, B, C, D, or F) to a numeric test score.
3  #include <iostream>
4  using namespace std;
5
6  int main()
7  {
8      int testScore; // To hold a numeric test score
9      char grade;    // To hold a letter grade
10
11     // Get the numeric test score.
12     cout << "Enter your numeric test score and I will\n";
13     cout << "tell you the letter grade you earned: ";
14     cin >> testScore;
15
16     // Determine the letter grade.
17     if (testScore < 60)
18         grade = 'F';
19     else if (testScore < 70)
20         grade = 'D';
21     else if (testScore < 80)
22         grade = 'C';
23     else if (testScore < 90)
24         grade = 'B';

```

*(Program Continues)*

**Program 4-10** *(continued)*

```

25     else if (testScore <= 100)
26         grade = 'A';
27
28     // Display the letter grade.
29     cout << "Your grade is " << grade << ".\n";
30     return 0;
31 }

```

**Program Output with Example Input Shown in Bold**

```

Enter your numeric test score and I will
tell you the letter grade you earned: 88 [Enter]
Your grade is B.

```



## Using a Trailing `else`

- Used with `if/else if` statement when none of the *expressions* are true
- Provides default statement/action
- Used to catch invalid values, other exceptional situations

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## *From Program 4-12*

```
17  if (testScore < 60)
18      cout << "Your grade is F.\n";
19  else if (testScore < 70)
20      cout << "Your grade is D.\n";
21  else if (testScore < 80)
22      cout << "Your grade is C.\n";
23  else if (testScore < 90)
24      cout << "Your grade is B.\n";
25  else if (testScore <= 100)
26      cout << "Your grade is A.\n";
27  else
28      cout << "We do not give scores higher than 100.\n";
```

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## Nested if Statements

- An if statement that is part of the if or else part of another if statement
- Can be used to evaluate more than one condition:

```
if (score < 100)
{
    if (score > 90)
        grade = 'A';
}
```

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## Notes on coding nested ifs

- An else matches the nearest if that does not have an else:

```
if (score < 100)
    if (score > 90)
        grade = 'A';
    else ...// goes with second if,
           // not first one
```

- Proper indentation helps greatly

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## From pseudo code to C++ code

1. Start
2. Read decibels
3. If (decibels <= 30)
  - 3.1 print "Quiet"
4. Else if(decibels >=51)
  - 4.1 if (decibels <=70)
    - 4.1.1 print "annoying"
  - 4.2 end if
5. Else
  - 5.1 print "very annoying"
6. End if
7. end

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## In-Class Exercise

- Identify the logic errors, and correct them
  - The program will display "Pass" message, calculate the carry mark and display the carry mark if the student pass the test.
  - If the student fail the test the program will display "Fail" message and display a message to instruct the student to re-sit the test

```
int main()
{
    double mark, final20p = 0;

    cout << "Enter your mark >> ";
    cin >> mark;

    if (mark >= 30)
        cout << "TEST 1 -> Pass" << endl;
        final20p = ((20.0/100.0) * mark);
        cout << "Contribution to final mark " << final20p;
    if (mark < 30)
        cout << "TEST 1 -> Fail" << endl;
        cout << "Please re-sit TEST 1" << endl;

    system ("pause");
    return 0;
}
```

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## In-Class Exercise

- Do Lab 7, Exercise 1, No. 13 (ii & iii) (pg. 88)
- Do Lab 7, Exercise 2, No. 3(i) (pg. 98)

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## In-Class Exercise

- Do Lab 7, Exercise 1, No. 11 (pg. 86)
  - Change the `if` statements to `if..else` statements
  - What is the difference?

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## In-Class Exercise

- Write nested `if` statements that perform the following test:

If `amount1` is greater than 10 and `amount2` is less than 100, display the greater of the two.

- What is the output of the following C++ code :

```
#include <iostream>
using namespace std;
int main()
{ int x = 100, y=200;

    if(x>100 && y<=200)
        cout<<x<<" "<<y<<" "<<x+y<<endl;
    else
        cout<<x<<" "<<y<<" "<<2*x-y++<<endl;
    return 0;}
```

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## In-Class Exercise

- Do Lab 7, Exercise 3, No. 1 (pg. 101)
- Do Lab 7, Exercise 3, No. 2 (pg.102)

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