



# Computer Fundamentals

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Lecture 21



# Algorithm

- Derived from the name of a mathematician
  - ❑ Mohammed ibn-Musa al-Khwarizmi
- Set of steps to accomplish a task
  - ❑ Always leads to a solution
- Before writing a program to solve a problem, we require
  - ❑ Thorough understanding of problem
  - ❑ Carefully planned approach for solving
  - ❑ To understand available building blocks
  - ❑ Employ proven program construction techniques
- Important aspects of algorithm
  - ❑ Actions to execute
  - ❑ Order of execution

Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# Algorithm (cont.)

- Consider the rise-and-shine algorithm
  - ☐ Get out of bed
  - ☐ Take a shower
  - ☐ Get dressed
  - ☐ Eat breakfast
  - ☐ Go to University
  
- Suppose same steps are performed in different order
  - ☐ Get out of bed
  - ☐ Get dressed
  - ☐ Take a shower
  - ☐ Eat breakfast
  - ☐ Go to University

Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# Pseudocode

- Fake code
- Artificial and informal language
  - ❑ To develop algorithms without details of language **syntax**
  - ❑ Similar to everyday English
  - ❑ Convenient and user friendly
  - ❑ Not actual computer programming language
- Used to **conceptualize** program before **implementation**

Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# Pseudocode (cont.)

## ➤ Example of adding two numbers

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

int main ()
{
    int num1, num2, result;
    cout <<"Enter 1st number: ";
    cin >> num1;
    cout <<"Enter 2nd number: ";
    cin >> num2;
    result = num1 + num2;
    cout << "\nSum = " << result;
    cout << endl;
    return 0;
}
```

Prompt the user to enter integer num1  
READ num1

Prompt the user to enter integer num2  
READ num2


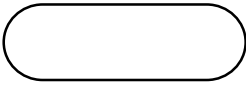
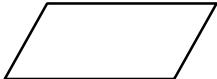

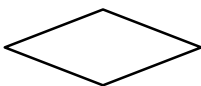

SET integer result as sum of num1 and num2  
DISPLAY result

Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# Flowchart

- Diagrammatic representation of algorithm
- Helpful in explaining program to others

Symbol	Purpose	Description
	Flow line	Indicate flow of logic by connecting symbols
	Terminal (Start/Stop)	Represent start and end of flowchart
	Input/Output	Input and output operation
	Processing	Arithmetic operations and data-manipulations
	Decision	Represent operation with alternatives
	Predefined function	Represent group of statements performing one task

Source: <http://www.programiz.com/article/flowchart-programming>

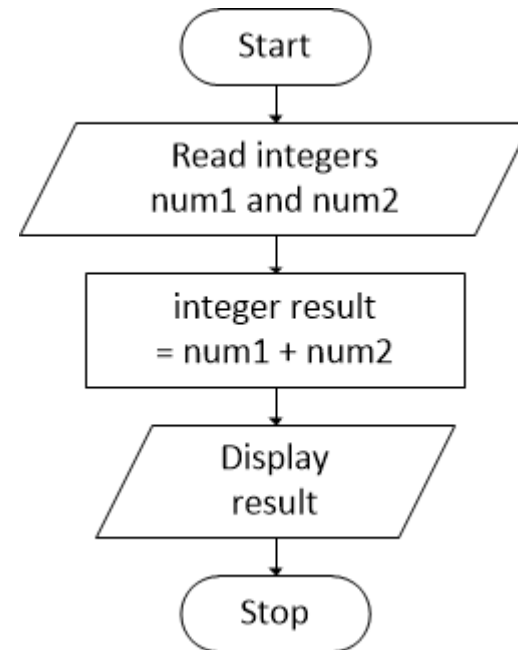


# Flowchart (cont.)

## ➤ Example of adding two numbers

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

int main ()
{
    int num1, num2, result;
    cout << "Enter 1st number: ";
    cin >> num1;
    cout << "Enter 2nd number: ";
    cin >> num2;
    result = num1 + num2;
    cout << "\nSum = " << result;
    cout << endl;
    return 0;
}
```



Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# Arithmetic Operations

- Arithmetic operations very important in programming
- Several operations possible

Operation	Arithmetic operator	Algebraic expression	Programming expression	Precedence
Addition	+	$d + 7$	<code>d + 7</code>	Third
Subtraction	-	$a - c$	<code>a - c</code>	Third
Multiplication	*	$b t$ or $b . t$	<code>b * t</code>	Second
Division	/	$x / y$ or $x \div y$	<code>x / y</code>	Second
Modulus	%	$n \% d$	<code>n \% d</code>	Second
Parentheses	( )	( )	( )	First

Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition





# Integer Variable

- Integer variable hold value to the left of decimal point
- Values to the right of decimal point discard

```
SET integer i equal to 3.9  
DISPLAY i
```

- ❑ The output would be 3 and not 3.9
- ❑ Integer does not hold value to the right of decimal point



# if statement

- Allows program to take alternative action
  - ❑ Based on whether a condition is true or false
- If condition is true
  - ❑ Statement in body of `if` statement executed
- If condition is false
  - ❑ Body statement not executed
- Equality operators and relational operators used

Operator	Equality or relational operator	Sample condition	Meaning of condition
Relational Operators	>	$x > y$	x greater than y
	<	$x < y$	x less than y
	>=	$x \geq y$	x greater than or equal to y
	<=	$x \leq y$	x less than or equal to y
Equality operators	==	$x == y$	x equal to y
	!=	$x != y$	x not equal to y

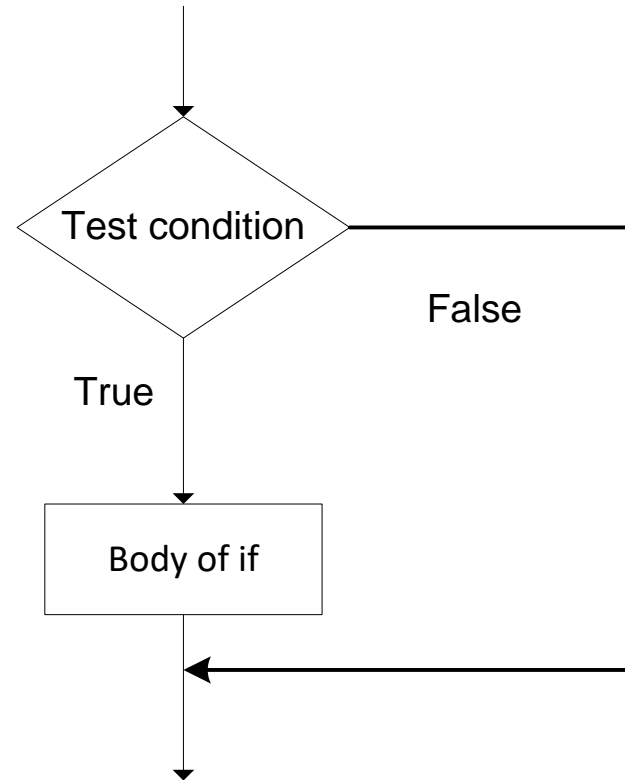
Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# if statement (cont.)

## ➤ Pseudocode and flow chart of `if` statement

IF condition  
  Body of IF  
END IF



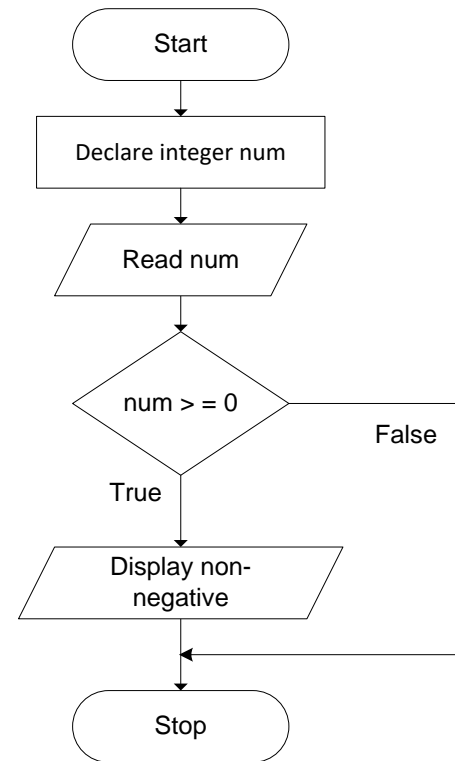


# if statement (cont.)

- A program to check whether an integer entered by user is non-negative

Prompt the user to enter integer num  
READ num

IF num is greater than or equal to 0  
    DISPLAY non-negative  
END IF





# if else statement

- Allows program to take alternative action
  - ❑ Based on whether a condition is true or false
- If condition is true
  - ❑ Statement in body of `if` statement executed
- If condition is false
  - ❑ Body statement of `else` statement executed
- Equality operators and relational operators used

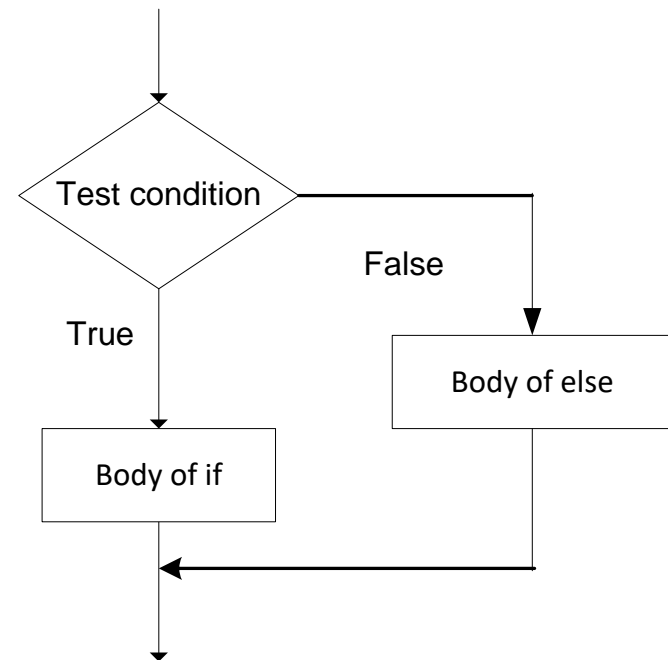
Source: Deitel & Deitel, "C++, How to Program", 8<sup>th</sup> Edition



# if else statement (cont.)

## ➤ Pseudocode and flow chart of if else statement

```
IF condition
  Body of IF
ELSE
  Body of ELSE
END IF
```



Source: <http://www.programiz.com/c-programming/c-if-else-statement>

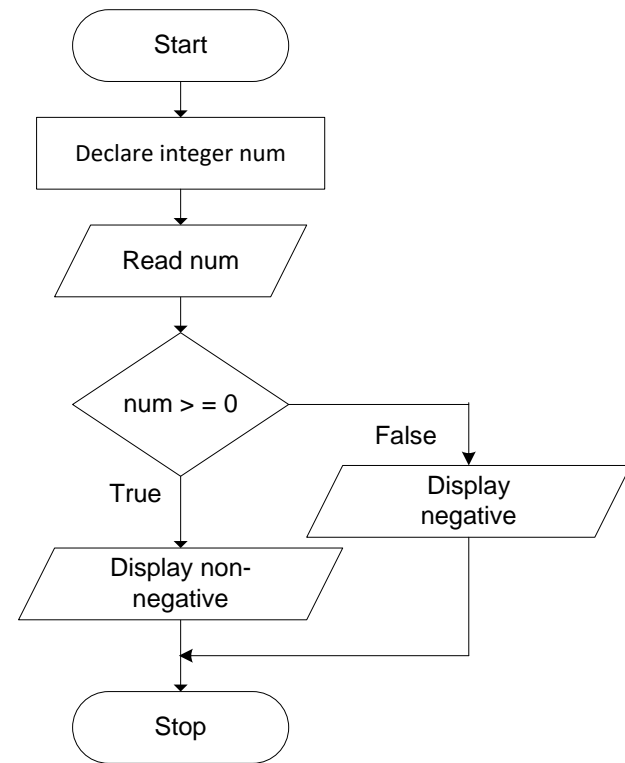


# if else statement (cont.)

- A program to check whether an integer entered by user is non-negative or negative

Prompt the user to enter integer num  
READ num

IF num is greater than or equal to 0  
    DISPLAY non-negative  
ELSE  
    DISPLAY negative  
END IF



Source: [http://users.csc.calpoly.edu/~jdalbey/SWE/pdl\\_std.html](http://users.csc.calpoly.edu/~jdalbey/SWE/pdl_std.html)



# Nested if else statements

- if else statements nested inside another else
- If one condition fails, another condition is checked
- Used when more than one test conditions are required
  - ❑ If first condition is true, body executed
  - ❑ Otherwise, second condition is tested
    - If second condition is true, body executed
    - Otherwise, third condition is tested

Source: <http://www.programiz.com/c-programming/c-if-else-statement>



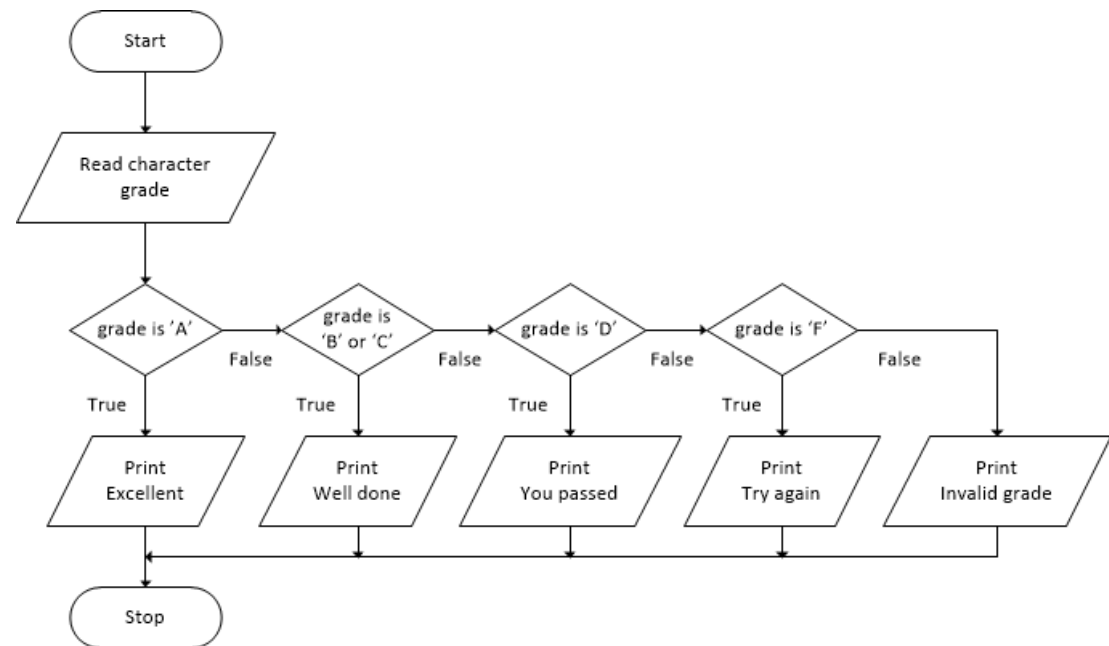


# Nested if else statements (cont.)

- A program about exam grade (A, B, C, D, F) and remarks

Prompt the user to enter character grade  
READ grade

```
IF grade is 'A'  
  DISPLAY Excellent  
ELSE  
  IF grade is 'B' or 'C'  
    DISPLAY Well done  
  ELSE  
    IF grade is 'D'  
      DISPLAY You passed  
    ELSE  
      IF grade is 'F'  
        DISPLAY Try again  
      ELSE  
        DISPLAY Invalid grade  
      END IF  
    END IF  
  END IF  
END IF
```





# Class Task

- Write the pseudocode and draw flowchart for a program that reads an integer from the user and checks whether the number is odd or even.