BIRZEIT UNIVERSITY

Algorithm

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Comp 131

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Algorithm & Pseudocode

- An algorithm is a procedure or formula for solving a problem.

- Pseudocode is a kind of structured English for describing algorithms. It allows the designer to focus on the logic of the algorithm without being distracted by details of language syntax.

Example

- Let's say that you have a friend arriving at the airport, and your friend needs to get from the airport to your house. Here are three different algorithms that you might give your friend for getting to your home:

Example Cont.

- The taxi algorithm:
  - Go to the taxi stand.
  - Get in a taxi.
  - Give the driver my address.

Example Cont.

- The call-me algorithm:
  - When your plane arrives, call my cell phone.
  - Meet me outside baggage claim.

Example Cont.

- The bus algorithm:
  - Outside baggage claim, catch bus number 70.
  - Transfer to bus 14 on Rukab Street.
  - Get off on Jerusalem street.
  - Walk two blocks north to my house.

Common Action Keywords

- Input: READ , OBTAIN, GET
- Output: PRINT, DISPLAY, SHOW
- Compute: COMPUTE, CALCULATE
- Initialize: SET
- Add one: INCREMENT

Types of Algorithm operations

- Sequential
- Conditional
- Iterative

Sequential

- Computation operations

Example:

Set the value of “variable” to “value” or “arithmetic expression”

- Variable

Named storage location that can hold a data value

Sequential

- Input operations
  - To receive data values from the user.

  Example

  Get a value for r, the radius of the circle
- Output operations
  - To send results to the screen for display.

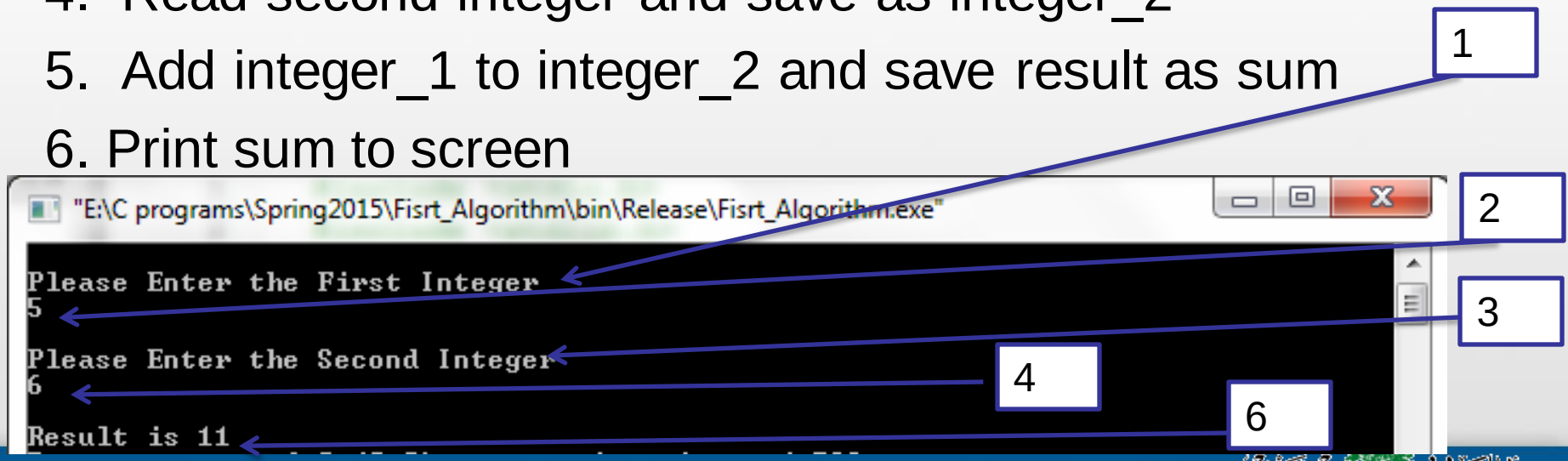
  Example

  Print the value of Area

Sequential

- Write an algorithm to find and print the sum of two integers ?

1. Ask user to enter first integer
2. Read the integer and save as integer_1
3. Ask user to enter the second integer
4. Read second integer and save as integer_2
5. Add integer_1 to integer_2 and save result as sum
6. Print sum to screen



Sequential

- Write an algorithm to find and print the area of rectangle.

1. Ask user to enter the height of rectangle.
2. Read height and save as rectangle_height.
3. Ask user to enter the width of rectangle.
4. Read width and save as rectangle_width.
5. Multiply rectangle_heigh by rectangle_width and save the result as area.
6. Display area.

Sequential

- Write an algorithm to reverse any two digits number.

1. Ask user to enter two digits number.
2. Read number and save as num.
3. Divide num by ten and save result as tens.
4. Divide num by ten and save remainder as rem.
5. Multiply rem by ten and save the result as rev.
6. Add tens to rev.
7. Print rev.

Suppose num=12
tens=num /10 =12/10→tens=1
rem=num%10=12%10→rem=2
rev=rem*10=2*10→rev=20
rev=rev+tens=20+1→rev=21

Conditional

- IF
- Case

Conditional

- Ask questions and choose alternative actions based on the answers.

Example

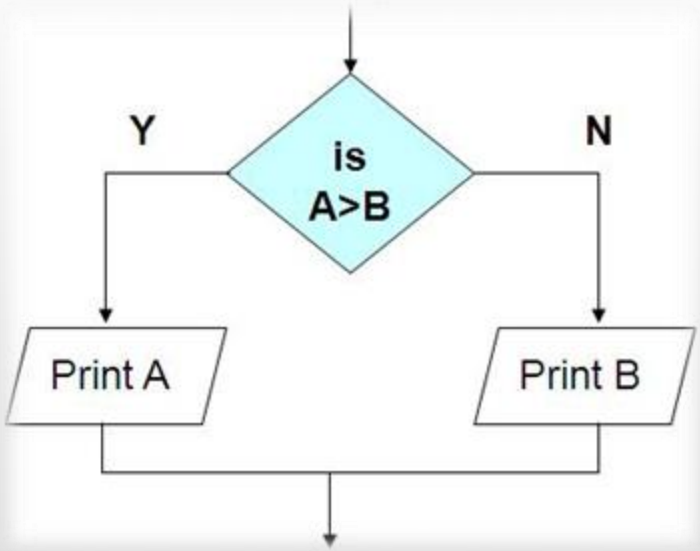
if *A* is greater than B then

print *A*

else

print *B*

end if



Conditional

ELSE keyword is optional

```
IF  condition THEN
        Sequence
END IF
```

```
IF  condition THEN
        Sequence 1
 ELSE IF  condition THEN
        Sequence 2
 ELSE IF  condition THEN
        Sequence 3
 ELSE
        Sequence 4
END IF
```

Conditional

Logical Operators :

- AND
- OR

Relational Operators :

- Greater than
- Greater than or equal
- Less than
- Less than or equal
- Equal
- Not Equal

Conditional

Write an algorithm to print passed or failed based on the student grade.

1. Ask user to enter student grade.
2. Read grade and save as student_grade.
3. If student_grade greater than or equal sixty then

```
        print “passed”
else
        print “failed”
end if
```

Conditional

Write an algorithm to find and print the maximum element of a set of 3 integers.

1. Ask user to enter the first integer.
2. Read the integer and save as first_integer.
3. Ask user to enter the second integer.
4. Read the integer and save as second_integer.
5. Ask user to enter third integer.
6. Read the integer and save as third_integer.

7. Let max equal to the first_integer.
8. If max less than second_integer then
   set max to second_integer
   end if
9. If max less than third_integer then
   set max to third_integer
   end if
10. Print “the maximum integer is” max

Conditional

Write an algorithm to find and print the smallest of three given numbers (assume all numbers are different).

1. Ask user to enter first number
2. Read number and save as num1
3. Ask user to enter second number
4. Read number and save as num2
5. Ask user to enter third number
6. Read number and save as num3
7. If num1 smaller than num2 **and** num1 smaller than num3 then
   print "num1 is the smallest"
   else If num2 smaller than num1 **and** num2 smaller than num3 then
   print "num2 is the smallest"
   else
   print "num3 is the smallest"
   end if

Rules for logical And operations		
T	T	T
T	F	F
F	T	F
F	F	F

Conditional

Write an algorithm to read a number x and display its sign.

1. Ask user to enter a number
2. Read number and save as X
3. If x is greater than zero then
   print x "is positive"
   else if x is equal zero then
   print x "is zero"
   else
   print x "is negative"
   end if

Conditional

Write an algorithm that will input student average. If the average is greater than or equal to 60 and less than or equal to 70, the algorithm should display "Passed". If it is greater than 70 and less than or equal to 80, print "Good". If it is greater than 80 and less than 90, print "Very good". If it is greater than 90 , print "Excellent". If it is less than 60 the prints "Fail".

Conditional

1. Ask user to enter student average
2. Read average and save as ag
3. If ag is greater than or equal to sixty and ag is less than or equal to seventy then
   print “Pass”
   else if ag is greater than seventy and ag is less than or equal to eighty then
   print “Good”
   else if ag is greater than eighty and ag is less than ninety then
   print “Very good”
   else if ag is greater than ninety then
   print “Excellent”
   else
   print “Fail”
   end if

Rules for logical OR operations		
T	T	T
T	F	T
F	T	T
F	F	F

Iterative

- **Perform "looping" behavior; repeating actions until a continuation condition becomes false**

(1)

WHILE condition

sequence

END WHILE

(2)

REPEAT

sequence

UNTILE condition

(3)

FOR iteration bounds

sequence

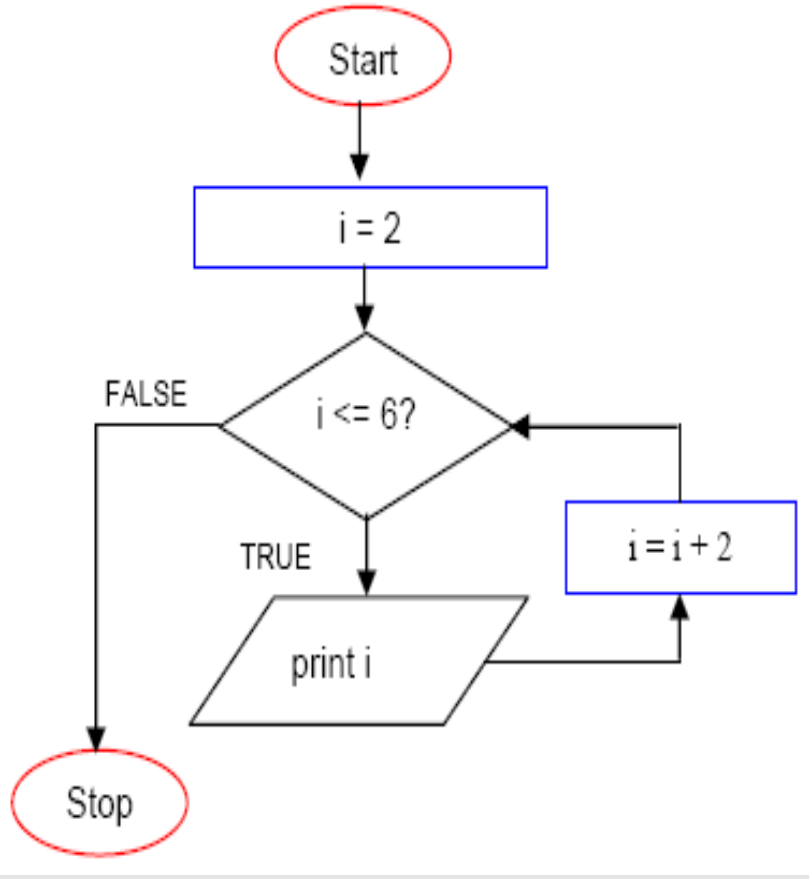
END FOR

Iterative

1. Set i equal to two
2. While i less than or equal six
   print i
   add two to i
   end while

Output:

2 4 6



Iterative

- Write an algorithm to calculate the average of a set of 10 students.

Solution 1

1. Set counter to zero
2. Set total to zero
3. While counter is less than ten
   Ask user to enter grade
   Read grade and save as gd
   Add the gd into the total
   increment counter
   end while
4. Set the average to the total divided by counter
5. Print “the average is ” average

Solution 2

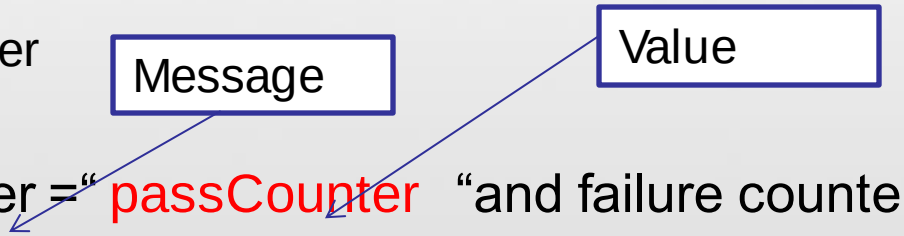
1. Set counter to one
2. Set total to zero
3. While counter is less than or equal ten
   Ask user to enter grade
   Read grade and save as gd
   Add the gd into the total
   increment counter
   end while
4. Set the average to the total divided by ten
5. Print “the average is ” average

Iterative

Write an algorithm that will count the number of student pass in a class and the amount failed. The pass mark is more than or equal to 65. Suppose the number of students are 30 . The algorithm should output the amount fail and passed.

Iterative

1. Set counter to zero
2. Set passCounter to zero
3. Set failureCounter to zero
4. While counter less than thirty
   Ask user to enter student average
   Read average and save as ag
   if ag greater than or equal sixty five then
   increment passCounter
   else
   increment failureCounter
   end if
   increment counter
   end while
6. Print “pass counter =“ passCounter “and failure counter =“ failureCounter



Extra Exercises

1. Write an algorithm that takes n integers and decides and prints the number of integers divisible by 3 and the number of integers not divisible by 3.

2. Write an algorithm that will accept the values of the sides of a square and display its area where the formula is : area = side*side

Extra Exercises

Solutions:

Extra Exercises _1.txt
Extra Exercises _2.txt

Extra Exercises

•Write an algorithm to calculate the sum of a set of values (we don't know their count). When 0 is entered this means that algorithm should stop receiving data, and print the sum

Write an algorithm to calculate the sum of a set of values (we don't know their count). When the sum exceeds 25 this means that algorithm should stop receiving data, and print the number of values were entered.