

Introduction to ...
Programming using **C**

Student workbook

Dr. Mostafa Abdelkhalik Elhosseini

Associate Professor

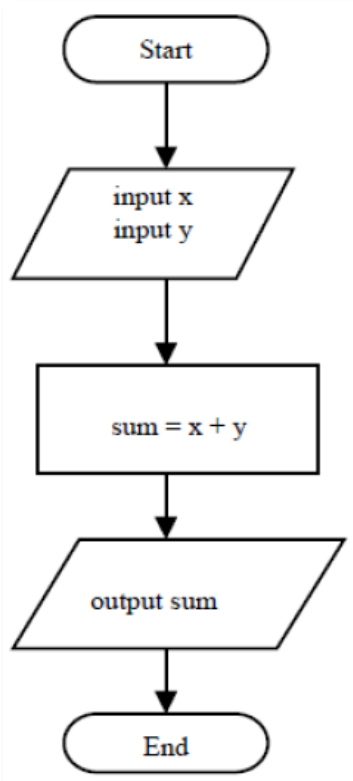
Computers Engineering & Control Systems Dept.

Mansoura University

2017 - 2018

Flowchart 01

What is the function of this flowchart program?



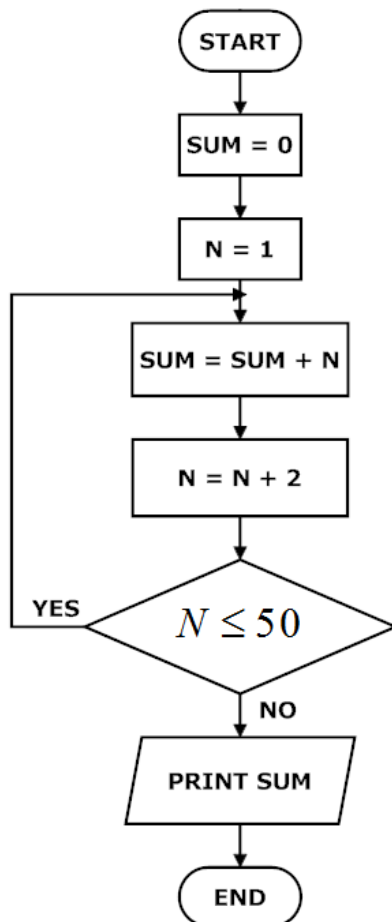
Tasks

- What is the function of each symbol?
- Are you free to write free-format code inside each symbol or you are constrained to something?

Flowchart 02

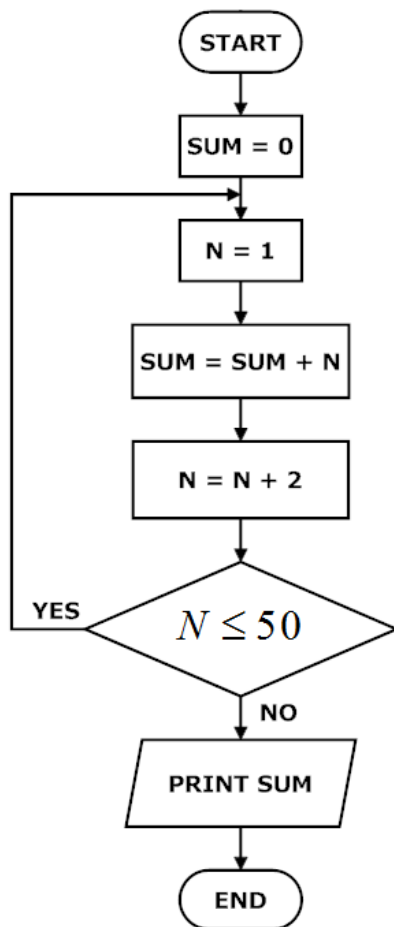
Step through the flowchart, and write down the formula for

SUM variable



Flowchart 03

Step through the flowchart, and write down the formula for SUM variable

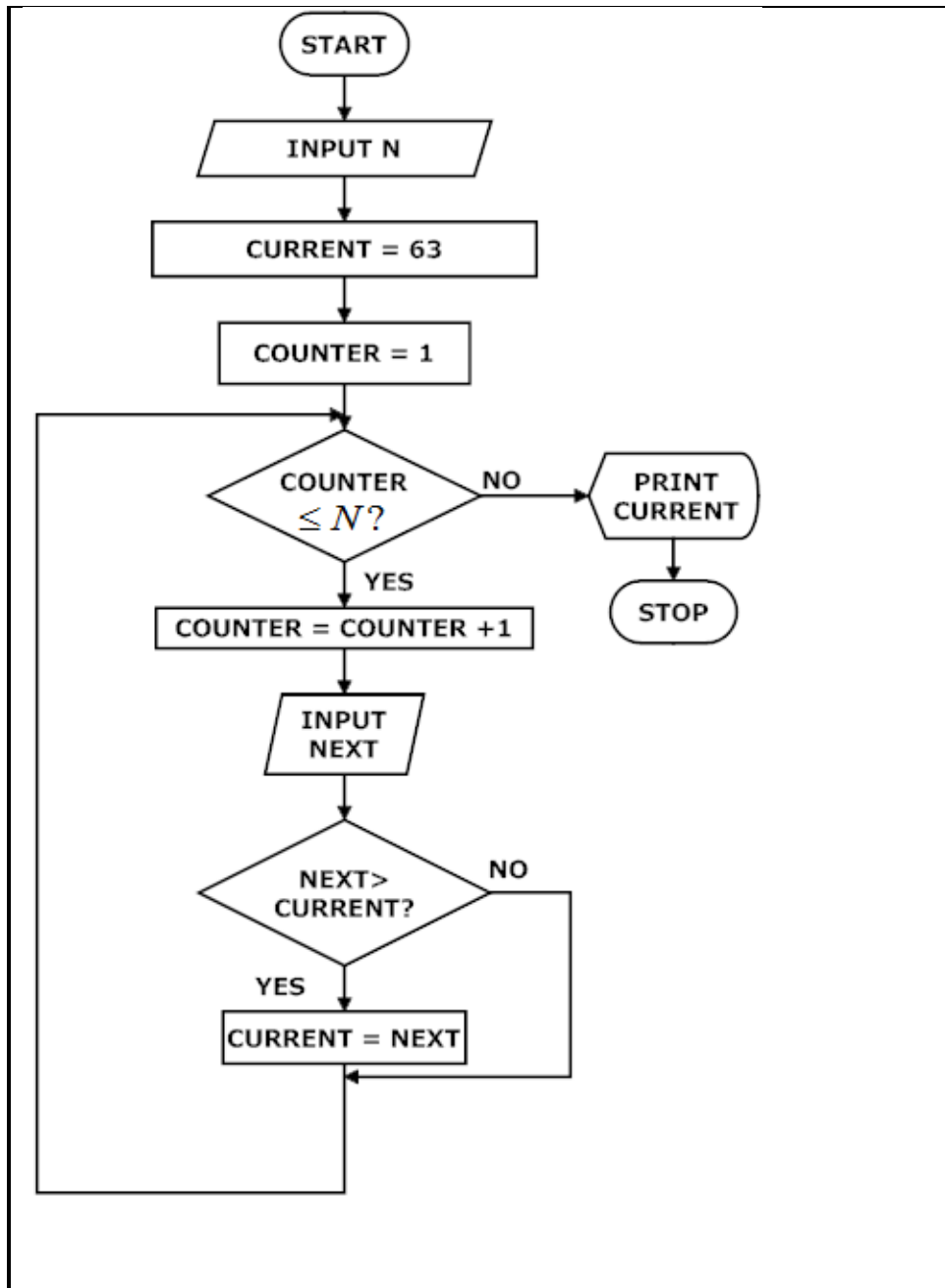


Flowchart 04

Assuming the user enter these values while running the code equivalent to flowchart below, step through the flowchart and find the value of the MAX value

$N = 5$

$Next = 21.35. -11.19.40$



Prob. 01

```
1  #include <stdio.h>
2  #include <stdlib.h>
3
4  main()
5  {
6      int x1;
7      int x2;
8      int s;
9      scanf("%d",&x1);
10     scanf("%d",&x2);
11     s = x1+x2;
12     printf("%d",s);
13     getch();
14
15 }
```

Tasks:

- Have a look on CodeBlocks (C IDE)
 - Know how to open CodeBlocks
 - Know how to create a c source file
 - Know how to write a source code
 - Know how to compile and execute a program
 - Know how to locate your exe file in your folders
- Execute the above program and tell us what is the output
- What is the function of **int** here?
- What is the function of **address operator &** here?

- What is the function of **getche()** here?
 - Write a program that divides a number entered by the user by 2
 - Write a program that displays the 7 times table
 - Write a program that displays any times table the user requests
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Prob. 02

```
1  #include <stdio.h>
2  #include <stdlib.h>
3  #include <math.h>
4
5  main()
6  {
7      float a,b,c,s,A;
8      printf("Side 1: ");
9      scanf("%f",&a);
10     printf("Side 2: ");
11     scanf("%f",&b);
12     printf("Side 3: ");
13     scanf("%f",&c);
14     s = (a+b+c)/2;
15     A = sqrt(s*(s-a)*(s-b)*(s-c));
16     printf("Triangle Area = %f",A);
17     getch();
```

Tasks

- Execute the above program
 - Know how to define variable
 - Enumerate different variable types
 - Know how to assign a value to variable
 - Know how to import library
 - What is meaning of **sqrt** ?
 - List down some of these library
 - What is the function of the **m = (a+b+c)/2**
- How to read a variable?
- Is there any difference between **a, A**?

Prob. 03:

Create a program that reads the length and width of a farmer's field from the user in feet. Display the area of the field in acres.

Hint: There are 43,560 square feet in an acre.

Prob. 04:

Write a program that reads a positive integer, n , from the user and then displays the sum of all of the integers from 1 to n . The sum of the first n positive integers can be computed using the formula:

$$sum = \frac{n(n + 1)}{2}$$

Prob. 05:

An online retailer sells two products: widgets and gizmos. Each widget weighs 75 grams. Each gizmo weighs 112 grams. Write a program that reads the number of widgets and the number of gizmos in an order from the user. Then your program should compute and display the total weight of the order.

Prob. 06:

Pretend that you have just opened a new savings account that earns 4 percent interest per year. The interest that you earn is paid at the end of the year, and is added to the balance of the savings account. Write a program that begins by reading the amount of money deposited into the account from the user. Then your program should compute and display the amount in the savings account after 1, 2, and 3 years. Display each amount so that it is rounded to 2 decimal places.

Prob. 07:

Create a program that reads two integers, a and b, from the user. Your program should compute and display: (1) The remainder when a is divided by b (2) The result of a^b

Prob. 08:

Many people think about their height in feet and inches, even in some countries that primarily use the metric system. Write a program that reads a number of feet from the user, followed by a number of inches. Once these values are read, your program should compute and display the equivalent number of centimeters.

Hint: One foot is 12 inches. One inch is 2.54 centimeters.

Prob. 09:

Write a program that begins by reading a radius, r , from the user. The program will continue by computing and displaying the area of a circle with radius r and the volume of a sphere with radius r . Use the π constant in the math module in your calculations.

Prob. 10:

Create a program that determines how quickly an object is traveling when it hits the ground. The user will enter the height from which the object is dropped in meters (m). Because the object is dropped its initial speed is 0 m/s. Assume that the acceleration due to gravity is 9.8 m/s². You can use the formula $v_f = \sqrt{v_i^2 + 2ad}$ to compute the final speed, v_f , when the initial speed, v_i , acceleration, a , and distance, d , are known.

Prob. 11:

Write a program that begins by reading a temperature from the user in degrees Celsius. Then your program should display the equivalent temperature in degrees Fahrenheit and degrees Kelvin. The calculations needed to convert between different units of temperature can be found on the internet.

Prob. 12:

Develop a program that reads a four-digit integer from the user and displays the sum of the digits in the number. For example, if the user enters 3141 then your program should display $3+1+4+1=9$.

Prob. 13:

A triangle can be classified based on the lengths of its sides as equilateral (متساوي الأضلاع), isosceles (متساوي الساقين) or scalene (مختلف الأضلاع). All 3 sides of an equilateral triangle have the same length. An isosceles triangle has two sides that are the same length, and a third side that is a different length. If all of the sides have different lengths, then the triangle is scalene.

Write a program that reads the lengths of 3 sides of a triangle from _____ the _____ user. Display a message indicating the type of the triangle.

Prob. 14:

The following table contains earthquake magnitude ranges on the Richter scale and their descriptors:

Magnitude	Descriptor
Less than 2.0	Micro
2.0 to less than 3.0	Very minor
3.0 to less than 4.0	Minor
4.0 to less than 5.0	Light
5.0 to less than 6.0	Moderate
6.0 to less than 7.0	Strong
7.0 to less than 8.0	Major
8.0 to less than 10.0	Great
10.0 or more	Meteoric

Write a program that reads a magnitude from the user and displays the appropriate descriptor as part of a meaningful message. For example, if the user enters 5.5 then your program should indicate that a magnitude 5.5 earthquake is considered to be a moderate earthquake.

Prob. 15:

At a particular university, letter grades are mapped to grade points in the following manner:

letter	Grade points
A+	4.0
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
F	0

Write a program that begins by reading a letter grade from the user. Then your program should compute and display the equivalent number of grade points. Ensure that your program generates an appropriate error message if the user enters an invalid letter grade.

Prob. 16:

The wavelength of visible light ranges from 380 to 750 nanometers (nm). While the spectrum is continuous, it is often divided into 6 colors as shown below:

Color	Wavelength (nm)
Violet	380 to less than 450
Blue	450 to less than 495
Green	495 to less than 570
Yellow	570 to less than 590
Orange	590 to less than 620
Red	620 to 750

Write a program that reads a wavelength from the user and reports its color. Display an appropriate error message if the wavelength entered by the user is outside of the visible spectrum.

Prob. 17:

Electromagnetic radiation can be classified into one of 7 categories according to its frequency, as shown in the table below:

Name	Frequency range (Hz)
Radio waves	Less than 3×10^9
Microwaves	3×10^9 to less than 3×10^{12}
Infrared light	3×10^{12} to less than 4.3×10^{14}
Visible light	4.3×10^{14} to less than 7.5×10^{14}
Ultraviolet light	7.5×10^{14} to less than 3×10^{17}
X-rays	3×10^{17} to less than 3×10^{19}
Gamma rays	3×10^{19} or more

Write a program that reads the frequency of the radiation from the user and displays the appropriate name.

Prob. 18:

In this exercise you will create a program that computes the average of a collection of values entered by the user. The user will enter 0 as a sentinel value to indicate that no further values will be provided. Your program should display an appropriate error message if the first value entered by the user is 0.

Hint: Because the 0 marks the end of the input it should not be included in the average.

Prob. 19:

Write a program that displays a temperature conversion table for degrees Celsius and degrees Fahrenheit. The table should include rows for all temperatures between 0 and 100 degrees Celsius that are multiples of 10 degrees Celsius. Include appropriate headings on your columns. The formula for converting between degrees Celsius and degrees Fahrenheit can be found on the internet.

Prob. 20:

A particular zoo determines the price of admission based on the age of the guest. Guests 2 years of age and less are admitted without charge. Children between 3 and 12 years of age cost \$14.00. Seniors aged 65 years and over cost \$18.00. Admission for all other guests is \$23.00. Create a program that begins by reading the ages of all of the guests in a group from the user, with one age entered on each line. The user will enter a blank line to indicate that there are no more guests in the group. Then your program should display the admission cost for the group with an appropriate message. The cost should be displayed using two decimal places.

Prob. 21:

In this exercise you will create a program that displays a multiplication table that shows the products of all combinations of integers from 1 times 1 up to and including 10 times 10. Your multiplication table should include a row of labels across the top of it containing the numbers 1 through 10. It should also include labels down the left side consisting of the numbers 1 through 10. The expected output from the program is shown below:

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

When completing this exercise, you will probably find it helpful to be able to print out a value without moving down to the next line. This can be accomplished by added `end=""` as the last parameter to your print statement. For example, `print("A")` will display the letter A and then move down to

the next line. The statement `print("A", end="")` will display the letter A without moving down to the next line

Prob. 22:

The height of an object dropped from a starting height of 100 meters is given by the equation $h = 100 - 4.9 * t^2$ where t is the time in seconds. Write a Python program that asks the user for a time less than 20 seconds and displays the height of the object at that time using this formula. The program output should look similar to:

Enter the time:2

The object is at 80.4 meters

Prob. 23:

The velocity of a moving fluid can be found from the difference between the total and static pressures P_t and P_s . For water this is given by $V = 1.016\sqrt{P_t - P_s}$. Write a Python program that will receive as input the total and static pressures and will print the velocity of the water

Prob. 24:

Calculate the geometric average of a list of numbers, using the formula

$$x_{average} = [x_1 x_2 x_3 \dots x_n]^{1/n}$$

Test your program with the following six data items 6.2, 12.3, 5.0, 18.8, 7.1, 12.8

Compare the results obtained with the arithmetic average of the same data. Which average is larger

Prob. 25:

Write a Python program that will calculate and display the real roots of n quadratic equation $ax^2 + bx + c = 0$ using the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Assume that a , b and c are floating-point arguments whose values are given, and that x_1 and x_2 are floating-point variables.