

Part 01

Conditional Statements

----- BASIC -----

1. Write a program that allows user to enter any integer named **a** and then checks that the number entered is positive, negative, or zero.

Example 1: Please enter any integer: 2
2 is a positive number

Example 2: Please enter any integer: -9
-9 is a negative number

Example 3: Please enter any integer: 0
The number entered is zero

2. Write a program that allows user to enter any number named **n** and then calculates square root of the number entered. Before calculating the square root, the program needs to check whether the input number is negative or not.

Hint: use the function `double sqrt (double n)` of the **math.h** library to calculate the square root of the parameter **n**.

Example 1: Please enter any number: -2
Accept positive number only!

Example 2: Please enter any number: 15
Square root of 15.000000 is 3.872983

Example 3: Please enter any number: 0
Square root of 0.000000 is 0.000000

3. Write a program that allows user to enter two **integers** called **m** and **n** then calculates the value of **m divided by n**. Before dividing, the program must check whether the denominator is zero.

Example 1: Please enter numerator : 7
Please enter denominator: 0
The denominator can't be zero!

Example 2: Please enter numerator : -8
Please enter denominator: -5
Result: -8 / -5 = 1.600000

Example 3: Please enter numerator : 10
Please enter denominator: -2
Result: 10 / -2 = -5.000000

4. Write a program that allows user to enter two integers called **a** and **b** then compares the values of the two numbers entered.

Example 1: Please enter the first number: 9
Please enter the second number: 5
Comparison results: 9 is greater than 5

Example 2: Please enter the first number: 3
Please enter the second number: 18
Comparison results: 3 is less than 18

Example 3: Please enter the first number: 13
Please enter the second number: 13
Comparison results: both numbers are equal

----- GEOMETRY -----

5. Write a program that allows the user to enter the edge called **a** of the square and then calculates the perimeter and area of the square. The program must check whether the square edge is a positive number or not.

Formula

$$\begin{aligned}\text{Perimeter} &= 4 * a \\ \text{Area} &= a * a\end{aligned}$$

Example 1: Please enter the edge of the square: -6
The edge must be a positive number!

Example 2: Please enter the edge of the square: 0
The edge must be a positive number!

Example 3: Please enter the edge of the square: 10
The perimeter of the square is 40
The area of the square is 100

6. Write a program that allows the user to enter the width (**w**) and the height (**h**) of the rectangle and then calculates the perimeter and area of the rectangle. The program must check whether the width and the height is a positive number or not.

Formula

$$\begin{aligned}\text{Perimeter} &= 2 * (w + h) \\ \text{Area} &= w * h\end{aligned}$$

Example 1: Please enter the width of the rectangle: -9
Please enter the height of the rectangle: 3
The edge of rectangle must be a positive number!

Example 2: Please enter the width of the rectangle: 15
Please enter the height of the rectangle: 0
The edge of rectangle must be a positive number!

Example 3: Please enter the width of the rectangle: 5
Please enter the height of the rectangle: 12
The perimeter of the rectangle is 34
The area of the rectangle is 60

7. Write the program that allows the user to enter the three edges (**a**, **b** and **c**) of the triangle then calculates the perimeter and area of the triangle. The program must check that the three input numbers can make a triangle or not.

Formula

$$\begin{aligned}\text{Perimeter} &= a + b + c \\ \text{Area} &= \sqrt{p * (p - a) * (p - b) * (p - c)} \quad (p = \text{Perimeter} / 2)\end{aligned}$$

Hint: use the function **double sqrt (double n)** of the **math.h** library to calculate the square root of the parameter **n**.

Example 1: Please enter the first edge of triangle: -9
Please enter the second edge of triangle: 7
Please enter the third edge of triangle: 5
These three numbers must be a positive number!

Example 2: Please enter the first edge of triangle: 4
 Please enter the second edge of triangle: -9
 Please enter the third edge of triangle: 0
 These three numbers must be a positive number!

Example 3: Please enter the first edge of triangle: 1
 Please enter the second edge of triangle: 2
 Please enter the third edge of triangle: 10
 These three numbers do not make a triangle!

Example 4: Please enter the first edge of triangle: 4
 Please enter the second edge of triangle: 5
 Please enter the third edge of triangle: 6
 The perimeter of the triangle is 15
 The area of the triangle is 9.921567

8. Write a program that allows the user to enter the radius called **r** of the circle and then calculates the perimeter and area of the circle. The program must check whether the radius is a positive number or not.

Formula

$$\begin{aligned}\text{Perimeter} &= 2 * \pi * r \\ \text{Area} &= \pi * r * r\end{aligned}$$

Note: The value of π is **3.141593**

Example 1: Please enter the radius of the circle: -2
 The radius must be a positive number!

Example 2: Please enter the radius of the circle: 0
 The radius must be a positive number!

Example 3: Please enter the radius of the circle: 10
 The perimeter of the circle is 62.831860
 The area of the circle is 314.159300

9. Write a program that allows the user to enter the height (**h**) and the base's radius (**r**) of the cylinder and then calculates the total surface area and volume of the cylinder. The program must check whether the height and the radius is a positive number or not.

Formula

$$\begin{aligned}\text{Perimeter of base (pb)} &= 2 * \pi * r \\ \text{Area of base (ab)} &= \pi * r * r \\ \text{Total surface area (tsa)} &= h * pb + 2 * ab \\ \text{Volume (v)} &= h * ab\end{aligned}$$

Note: The value of π is **3.14159265358979323846** (use the constant **M_PI** of the **math.h** library)

Example 1: Please enter the base's radius of the cylinder: -2
 Please enter the height of the cylinder: 0
 The height and radius of cylinder must be a positive number!

Example 2: Please enter the base's radius of the cylinder: 1
 Please enter the height of the cylinder: 2
 The total surface area of the cylinder is 18.8495559215
 The volume of the cylinder is 6.2831853072

-----ALGEBRA-----

10. Write a program that allows the user to enter dividend called **a**. The program must calculate the quotient and the remainder of **a** divided by 2.

Example: Please enter any integer: 9
 The quotient of 9 divided by 2 is 4
 The remainder of 9 divided by 2 is 1

11. Write a program that allows the user to enter dividend called **a** and divisor called **b**. The program must calculate the quotient and the remainder of **a** divided by **b**.

Example 1: Please enter dividend: 23
 Please enter divisor : 7
 The quotient of 23 divided by 7 is 3
 The remainder of 23 divided by 7 is 2

Example 2: Please enter dividend: 104
 Please enter divisor : 0
 The divisor can't be zero!

Theory

If a is divisible by b, so the remainder of a divided by b is 0 (that mean $a \% b == 0$).

If a is divisible by b then **a is called a multiple of b** and **b is called a divisor of a**.

If a is divisible by 2 then a is an even number (that mean $a \% 2 == 0$). Else, a is an odd number.

12. Write a program that allows the user to enter dividend called **a** and divisor called **b**. The program must check whether a is **a multiple of b** or not.

Example 1: Please enter dividend: 23
 Please enter divisor : 7
 23 is not a multiple of 7

Example 2: Please enter dividend: 100
 Please enter divisor : 20
 100 is a multiple of 20

Example 3: Please enter dividend: 57
 Please enter divisor : 0
 The divisor can't be zero!

13. Write a program that allows the user to enter any integer called **a**. The program must check whether a is an even number or an odd number.

Example 1: Please enter dividend: 111
 111 is an odd number

Example 2: Please enter dividend: 2390
 2390 is an even number

Theory

Give a 4-digit number **n** = \overline{abcd} and n can be expressed as: $n = a*1000 + b*100 + c*10 + d$

The value of thousands is $a = n / 1000$

The value of hundreds is $b = (n / 100) \% 10$ or $b = (n \% 1000) / 10$

The value of tens is $c = (n / 10) \% 10$ or $c = (n \% 100) / 10$

The value of unit is $d = n \% 10$

14. Write a program that allows the user to enter any 4-digit positive integer called **n**. The program must parse and display the value of thousands, hundreds, tens and unit of **n**.

Example 1: Please enter 4-digit positive integer: -23
Accept integer from 1000 to 9999 only!

Example 2: Please enter 4-digit positive integer: 52640
Accept integer from 1000 to 9999 only!

Example 3: Please enter 4-digit positive integer: 7920
The value of thousands is 7
The value of hundreds is 9
The value of tens is 2
The value of unit is 0

15. Write a program that allows the user to enter any 4-digit positive integer called **n**. The program must sum the digits of the number entered.

Example 1: Please enter 4-digit positive integer: 483
Accept integer from 1000 to 9999 only!

Example 2: Please enter 4-digit positive integer: 7920
Sum all digits of 7920 is: 7 + 9 + 2 + 0 = 18

16. (*) Write a program that allows the user to enter any 4-digit positive integer called **n**. The program must find the reverse number of **n**.

Example 1: Please enter 4-digit positive integer: 198536
Accept integer from 1000 to 9999 only!

Example 2: Please enter 4-digit positive integer: 5287
The reverse number of 5287 is 7825

Example 3: Please enter 4-digit positive integer: 7920
The reverse number of 7920 is 297

Example 4: Please enter 4-digit positive integer: 6200
The reverse number of 6200 is 26

Example 5: Please enter 4-digit positive integer: 1000
The reverse number of 1000 is 1

17. (***) Write a program that allows the user to enter any 4-digit positive integer called **n**. The program whether **n** is a **palindromic number** or not.

Hint: A palindromic number is a number that remains the same when its digits are reversed.

Example: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 22, 33, 44, 55, 66, 77, 88, 99, 101, 111, 121, etc

Example 1: Please enter 4-digit positive integer: 198536
Accept integer from 1000 to 9999 only!

Example 2: Please enter 4-digit positive integer: 5287
5287 is not a palindromic number

Example 3: Please enter 4-digit positive integer: 1331
1331 is a palindromic number

Example 4: Please enter 4-digit positive integer: 4240
4240 is a palindromic number (because 4240 can be displayed as 04240)

Example 5: Please enter 4-digit positive integer: 7700
7700 is a palindromic number (because 7700 can be displayed as 007700)

Example 6: Please enter 4-digit positive integer: 6000
6000 is a palindromic number (because 6000 can be displayed as 0006000)

18. Write a program that allows the user to enter the amount of Vietnam, then converted to USD.

Hint: Use <https://www.xe.com/currencyconverter/convert/?Amount=1&From=USD&To=VND> to find the rate between VND and USD.

Reference value: \$1 = 23,207.23 VND

Access time: 17:54:23 Dec 12, 2018

Example 1: Please enter the amount of Vietnam dong: -400000
Accept positive integer only!

Example 2: Please enter the amount of Vietnam dong: 2890500
Conversion value: 2890500 VND = \$124.6206

19. Write a program that allows the user to enter the time, then convert the time entered into the total seconds.

Hint: Use scanf format specifiers `scanf("%d:%d:%d", &h, &m, &s)`

Example 1: Please enter the time with format hh:mm:ss >> 52:00:45
Hours must be from 00 to 23!

Example 2: Please enter the time with format hh:mm:ss >> 9:82:07
Minutes must be from 00 to 59!

Example 3: Please enter the time with format hh:mm:ss >> 17:0:-2
Seconds must be from 00 to 59!

Example 4: Please enter the time with format hh:mm:ss >> 10:20:30
Conversion value: 10:20:30 = $10*3600 + 20*60 + 30$ = 37230 seconds

20. (*) Write a program that allows the user to enter the time in seconds, then parse the time entered into formatted time hh:mm:ss.

Hint: Use printf format specifiers `printf("%02d:%02d:%02d", h, m, s)`

Example 1: Please enter the time in seconds: 37230
Conversion value: 37230 seconds = 10:20:30

Example 2: Please enter the time in seconds: 0
Conversion value: 0 seconds = 00:00:00

Example 3: Please enter the time in seconds: -3600
Accept positive integer only!

----- CHARACTERS AND ASCII TABLE -----

21. Write a program that allows the user to enter any integer from 0 to 255, then convert the value entered into ASCII character.

Example 1: Please enter the order of ASCII character: 572
The order of ASCII character must be from 0 to 255!

Example 2: Please enter the order of ASCII character: 65
The 65th ASCII character is 'A'

Example 3: Please enter the order of ASCII character: 97
The 97th ASCII character is 'a'

Example 4: Please enter the order of ASCII character: 48
The 48th ASCII character is '0'

Example 5: Please enter the order of ASCII character: 32
The 32th ASCII character is ' '

22. Write a program that allows the user to enter any ASCII character, then find the order of character from ASCII table.

Example 1: Please enter any ASCII character: C
The order of ASCII character 'C' is 67

Example 2: Please enter any ASCII character: 5
The order of ASCII character 'C' is 53

23. Write a program that allows the user to enter any alphabet, then convert the alphabet into uppercase alphabet.

Example 1: Please enter any alphabet: 5
You must enter an alphabet!

Example 2: Please enter any alphabet: g
The uppercase of 'g' is 'G'

Example 3: Please enter any alphabet: H
The uppercase of 'H' is 'H'

24. Write a program that allows the user to enter any uppercase alphabet, then convert the alphabet into lowercase alphabet.

Example 1: Please enter any uppercase alphabet: +
You must enter an uppercase alphabet!

Example 2: Please enter any uppercase alphabet: g
You must enter an uppercase alphabet!

Example 3: Please enter any uppercase alphabet: T
The lowercase of 'T' is 't'

25. Write a program that allows the user to enter any alphabet. If that alphabet is lowercase, the program will convert that alphabet into uppercase. Otherwise, the program will convert that alphabet into lowercase.

Example 1: Please enter any alphabet: 8
You must enter any alphabet!

Example 2: Please enter any alphabet: q
The uppercase of 'q' is 'Q'

Example 3: Please enter any alphabet: R
The lowercase of 'R' is 'r'

----- ADVANCED PRACTICE -----

26. (*) Write a program that allows the user to enter an integer **a**, a operator **c** (+, -, *, /, %) and an integer **b**. Based on mathematical operations **c** and two integer values **a** and **b**, the program calculates the results and presents the results on the screen.

Example 1: Please enter the first integer: -9
Please enter the operator (+, -, *, /, %): @
Accept +, -, *, /, % only!

Example 2: Please enter the first integer: 4
Please enter the operator (+, -, *, /, %): %
Please enter the second integer: 0
The divisor can't be zero!

Example 3: Please enter the first integer: -9
Please enter the operator (+,-,*,/,%): /
Please enter the second integer: 2
The result is: -9 / 2 = -4.500000

Example 4: Please enter the first integer: 8
Please enter the operator (+,-,*,/,%): *
Please enter the second integer: 5
The result is: 8 * 5 = 40

27. Write a program that allows the user to enter the full year and any month of that year. The program must find the number of date of this month.

Example 1: Please enter the full year: -9
The value of full year must be a positive integer!

Example 2: Please enter the full year: 1998
Please enter any month of 1998: 28
The value of month must be from 1 to 12!

Example 3: Please enter the full year: 2000
Please enter any month of 2000: 5
Number of date of 05/2000 is 31 dates

Example 4: Please enter the full year: 2016
Please enter any month of 2016: 2
Number of date of 02/2016 is 29 dates

Example 5: Please enter the full year: 2018
Please enter any month of 2018: 2
Number of date of 02/2018 is 28 dates

Example 6: Please enter the full year: 2100
Please enter any month of 2100: 2
Number of date of 02/2100 is 28 dates

28. (*) Write a program that allows the user to enter any date in **mm/dd/yyyy** format. The program must check whether the date entered is a valid date or not.

Hint: Use *scanf* format specifiers `scanf("%d/%d/%d", &m, &d, &y)`

Example 1: Please enter any date in mm/dd/yyyy format: 17/46/-9
Input error:
1. The value of full year must be a positive integer.
2. The value of month must be from 1 to 12.
3. The value of date must be from 1 to 31.

Example 2: Please enter any date in mm/dd/yyyy format: 10/35/2018
Input error: The value of date must be from 1 to 31.

Example 3: Please enter any date in mm/dd/yyyy format: 02/29/2018
02/29/2018 is an invalid date

Example 4: Please enter any date in mm/dd/yyyy format: 02/29/2016
02/29/2016 is a valid date

Example 5: Please enter any date in mm/dd/yyyy format: 3/5/2000
03/05/2000 is a valid date

Example 6: Please enter any date in mm/dd/yyyy format: 4/31/2010
04/31/2010 is an invalid date

29. Write a program that allows the user to enter two integers called **a** and **b**. The program must swap the values of these two variables.

Warning: don't allow printing tricks.

Example: Please enter the value for variable A: -9
 Please enter the value for variable B: 5
 These two variables before swapped are: A = -9 and B = 5
 These two variables after swapped are: A = 5 and B = -9

30. Write a program that allows the user to enter two integers called **a** and **b**. The program must solves linear equation " $A \cdot X + B = 0$ ".

Example 1: SOLVING LINEAR EQUATION $A \cdot X + B = 0$ PROGRAM:

 Please enter the coefficients A: 0
 Please enter the coefficients B: 0
 Every value for X is a solution to the linear equation $0 \cdot X + 0 = 0$

Example 2: SOLVING LINEAR EQUATION $A \cdot X + B = 0$ PROGRAM:

 Please enter the coefficients A: 0
 Please enter the coefficients B: 9
 There is no solution for the linear equation $0 \cdot X + 9 = 0$

Example 3: SOLVING LINEAR EQUATION $A \cdot X + B = 0$ PROGRAM:

 Please enter the coefficients A: -2
 Please enter the coefficients B: 5
 The linear equation $-2 \cdot X + 5 = 0$ has an unique root is $X = 2.50$

Example 4: SOLVING LINEAR EQUATION $A \cdot X + B = 0$ PROGRAM:

 Please enter the coefficients A: 10
 Please enter the coefficients B: 6
 The linear equation $10 \cdot X + 6 = 0$ has an unique root is $X = -0.60$

31. Write a program that allows the user to enter three integers called **a** and **b** and **c**. The program must solves quadratic equation " $A \cdot X^2 + B \cdot X + C = 0$ ".

Example 1: SOLVING QUADRATIC EQUATION $A \cdot X^2 + B \cdot X + C = 0$ PROGRAM:

 Please enter the coefficients A: 0
 Please enter the coefficients B: 2
 Please enter the coefficients C: -8
 The linear equation $2 \cdot X - 8 = 0$ has an unique root is $X = 4.00$

Example 2: SOLVING QUADRATIC EQUATION $A \cdot X^2 + B \cdot X + C = 0$ PROGRAM:

 Please enter the coefficients A: 1
 Please enter the coefficients B: -3
 Please enter the coefficients C: 2
 The quadratic equation $X^2 - 3 \cdot X + 2 = 0$ has two roots are:
 $X_1 = 1.00$ and $X_2 = 2.00$

Example 3: SOLVING QUADRATIC EQUATION $A \cdot X^2 + B \cdot X + C = 0$ PROGRAM:

Please enter the coefficients A: 1
Please enter the coefficients B: 2
Please enter the coefficients C: 1
The quadratic equation $X^2 + 2 \cdot X + 1 = 0$ has only one distinct root:
X1 = X2 = -1.00

Example 4: SOLVING QUADRATIC EQUATION $A \cdot X^2 + B \cdot X + C = 0$ PROGRAM:

Please enter the coefficients A: 1
Please enter the coefficients B: 2
Please enter the coefficients C: 3
The quadratic equation $X^2 + 2 \cdot X + 3 = 0$ has no solution