LAB01

FIT-HCMUS

Bài tập 1

Input n, calculate the sum of numbers divisible by 4 and not divisible by 5 that are less than n.

Bài tập 2

Calculate $S = 1 + \frac{2}{1} + \frac{3}{2} + \frac{4}{3} + \cdots + \frac{n}{n-1}$.

Bài tập 3

Calculate $S = 1! + 2! + 3! + \cdots + n!$.

Bài tập 4

- List all the divisors of the positive integer n.
- Determine how many divisors there are and find the sum of all these divisors.

Bài tập 5

- Write a program to check for prime numbers (a prime number is a number >= 2 with exactly 2 divisors: 1 and itself).
- Input n with $0 < n < 50$, find the largest prime number less than n.

Bài tập 6

- Find the greatest common divisor (GCD) of two numbers, a and b (Euclidean algorithm).
- Find the least common multiple (LCM) of two positive integers a and b.

Bài tập 7

Write a program to print the multiplication table (from 1-9) to the screen.

Bài tập 8

Write a program to print an isosceles triangle with a height of `h`.
For example, with `h = 4`:

```
   *
  ***
 *****
*******
```

Bài tập 9

For each minute spent running on a treadmill, the user will burn 3.6 calories. Write a program to display the number of calories burned after n minutes.

Bài tập 10

Assume a person's salary is 1 unit on the first day and 2 units on the second day and continues to double each day. Write a program that allows the user to input the number of working days `n` ($1 \leq$ `n`), display the salary for each working day, and finally output the total salary received after `n` days.

Bài tập 11

The population of city A is less than the population of city B. However, city A's population growth rate is higher than city B. Write a program that allows the user to enter the population and population growth rates of the two cities. Display the minimum number of years it will take for the population of city A to exceed that of city B.
Example:

- Population of city A: 4000, growth rate: 40% (after 1 year, the population of city A increases by 40%).
- Population of city B: 5000, growth rate: 20%.
- After 2 years, city A's population will exceed city B's population (after 1 year, population of city A: 5600, B: 6000; after 2 years, population of city A: 7840, B: 7200).

Bài tập 12

Input $n > 2$, calculate $F(n)$ of the Fibonacci sequence:

$$\begin{aligned} F_0 &= 0 \\ F_1 &= 1 \\ F_n &= F_{n-1} + F_{n-2} \end{aligned} \tag{1}$$

Bài tập 13

Assume that the order in a class list is sorted by the height of the students. The shortest student will have order number 1. Write a program to help the class teacher find the student's height at the top and the end of the list. The program allows the user to input a series of heights and stops when the user inputs 0. The program displays the student's height at the top of the list and the student's height at the end of the list. The unit of height is `m` (meter).
Example:

```
Enter height: 1.52
Enter height: 1.4
Enter height: 1.25
Enter height: 1.53
Enter height: 0

Height of the first student on the list: 1.25 (m)
Height of the last student on the list: 1.53 (m)
```

Bài tập 14

Write a program to simulate a simple calculator. The program should display the following calculation menu:

```
SIMPLE CALCULATOR
1. Addition
2. Subtraction
3. Multiplication
4. Division
0. Exit program

Your choice:
```

If the user inputs 1, the program allows the user to input 2 numbers and calculates the sum of those 2 numbers. Similarly, for 2, it performs subtraction, 3 for multiplication, and 4 for division. The program will repeat until the user inputs 0 (to exit the program).
Example:

```
SIMPLE CALCULATOR
1. Addition
2. Subtraction
3. Multiplication
4. Division
0. Exit program

Your choice: 3

Please enter the first number: 2
Please enter the second number: 3
Result: 2 * 3 = 6
----------------------------------------
SIMPLE CALCULATOR
1. Addition
2. Subtraction
3. Multiplication
4. Division
0. Exit program

Your choice: 0

You have exited the program!
```

Bài tập 15

Write a countdown timer program that displays on the screen as follows:

```
Enter minutes: 0
Enter seconds: 10

00:10
00:09
00:08
00:07
00:06
00:05 Tick tock
00:04 Tick tock
00:03 Tick tock
00:02 Tick tock
00:01 Tick tock
00:00 Ring ring ring
```

Bài tập 16

Assume that the first number of a sequence is x, where x is an integer.
The sequence is defined as follows:

$$\begin{cases} a_0 = x \\ a_{n+1} = \frac{a_n}{2}, & \text{if } a_n \text{ is even} \\ a_{n+1} = 3 \times a_n + 1, & \text{if } a_n \text{ is odd} \end{cases} \tag{2}$$

An integer k will exist such that $a_k = 1$.
Write a program that allows the user to input the value of x and then outputs the value of the integer k such that $a_k = 1$; also display the sequence $a_0, a_1, a_2, \ldots, a_k$.

Example:

- Input: $x = 75$
- Output:
  - $k = 14$
  - Sequence: 75, 226, 113, 340, 170, 85, 256, 128, 64, 32, 16, 8, 4, 2, 1

Test your program with the following values of x: 75, 111, 678, 732, 873, 2048, and 65535.

Bài tập 17 (*)

- Enter a positive integer and print its reverse. E.g., input: 123, output: 321.
- Count the number of odd and even digits of the positive integer n.

Bài tập 18

Write a program to enter hours, minutes, and seconds and check the validity of the input data.

Bài tập 19

Write a program to enter the scores of 3 subjects: Math, Physics, and Chemistry.

- If the total score is >=15 and no subject has a score below 4, print "Pass"
- If passing and all subjects are greater than 5, print the comment "Consistent performance in all subjects"
- If passing and at least one subject is below 5, print "Inconsistent performance in subjects"
- In other cases, print "Fail"

Bài tập 20

Write a program to enter a positive integer n. Check if n is a perfect square (a perfect square is a number whose square root is an integer).

Bài tập 21

Write a program to enter an integer n. Print "Even number" if n is even; otherwise, print "Odd number".

Bài tập 22

- Write a program to check for a leap year (a leap year is divisible by 4 and not divisible by 100 or divisible by 400).
- Enter a month and a year, then print the number of days in that month (months with 31 days: 1, 3, 5, 7, 8, 10, 12; months with 30 days: 4, 6, 9, 11; February has 28 or 29 days).

Bài tập 23

Write a program to enter a number from 0 to 9 and print its corresponding word. For example, if the input is 3, print "Three".

Bài tập 24

Enter 3 numbers a, b, c.

- Print the largest and smallest number.
- Print these 3 numbers in ascending order.

Bài tập 25

Enter the lengths of the 3 sides a, b, c of a triangle.

- Determine if these 3 sides can form a triangle.
- If yes, identify the type of triangle (scalene, isosceles, right, or equilateral).

Bài tập 26

Calculate the taxi fare based on the number of kilometers entered, given:

- The first km costs 15 units,
- From the 2nd to the 5th km costs 13.5 units each,
- From the 6th km onwards, costs 11 units each,
- If the distance is greater than 120 km, a 10% discount is applied to the total fare.

Bài tập 27

Write a program to calculate the electricity bill based on the previous and current meter readings entered from the keyboard. Print the previous reading, the current reading, and the total amount to be paid. Knowing that:

- The first 100 kWh cost 1000 units each,
- From 101 to 150 kWh costs 1200 units each,
- From 151 to 200 kWh costs 2000 units each,
- From 201 kWh onwards costs 2500 units each.

Bài tập 28

Write a program to calculate the fine for a car exceeding the speed limit (assuming the speed limit is 60 km/h) according to the following fines (with `x` being the number of km/h over the speed limit):

No.	Violation	Fine
1	$5 < \texttt{x} \leq 10$	0.7 million
2	$10 < \texttt{x} \leq 20$	2.5 million
3	$20 < \texttt{x} \leq 35$	5.5 million
4	$35 < \texttt{x}$	7.5 million

The program allows the user to enter `x` and outputs the amount of fine.

Bài tập 29

Write a program that allows the user to enter an integer `x` in the range of 0 to 35 ($0 \leq \texttt{x} \leq 35$). Print to the screen according to the following rules:

- If $\texttt{x} \leq 9$, print `x`.
- Print `A` if $\texttt{x} = 10$, `B` if $\texttt{x} = 11$, `C` if $\texttt{x} = 12$, ..., `Z` if $\texttt{x} = 35$.

Bài tập 30

According to the Pythagorean theorem, in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. Write a program that allows the user to input any 3 numbers and check whether these 3 numbers can form the sides of a right triangle.

Bài tập 31

Write a program that takes 3 numbers `a`, `b`, `c` as input and solves the equation $ax^2 + bx + c = 0$.

Bài tập 32

Write a program that simulates a basic calculator. The program allows the user to input 2 operands and 1 operator (the operators can be: + - * / %), then outputs the operation result to the screen.
For example:

- Input: Operand 1: 2, Operand 2: 4, Operator: +
- Output: "2 + 4 = 6" printed on the screen.

Bài tập 33

A bank in town A updates customers' accounts each month. The bank offers two types of accounts: savings and current (checking) accounts. Each customer must maintain a minimum balance. If the balance drops below the minimum, the customer will incur a service fee of $10 for a savings account and $25 for a current account. If the end-of-month balance is greater than or equal to the minimum balance, the account will earn interest as follows:

- Savings account: earns an interest rate of 4%.
- Current account: if the end-of-month balance - minimum balance $\geq$ $5000, the interest rate is 3%; otherwise, the interest rate is 5%.

Write a program that allows the user to input the account type (`char`; 's' for savings, 'c' for current), minimum balance (int), and end-of-month balance (int) of a customer. Print the total interest earned, if any, or the service fee.

Bài tập 34

One way to determine a person's health status is to measure the body fat percentage. The formulas to calculate body fat for men and women are as follows:

- Body fat calculation for women:
  - A1 = (weight $\times$ 0.732) + 8.987
  - A2 = wrist measurement (taken at the thickest point) / 3.140
  - A3 = waist measurement (taken at the navel) $\times$ 0.157
  - A4 = hip measurement (taken at the widest point) $\times$ 0.249
  - A5 = forearm measurement (taken at the thickest point) $\times$ 0.434
  - B = A1 + A2 – A3 – A4 + A5
  - Body fat = weight - B
  - Body fat percentage = body fat $\times$ 100 / weight
- Body fat calculation for men:
  - A1 = (weight $\times$ 1.082) + 9.442
  - A2 = wrist measurement $\times$ 4.15

- B = A1 - A2
- Body fat = weight - B
- Body fat percentage = body fat × 100 / weight

Write a program to calculate a person's body fat percentage.

Bài tập 35

Write a program to calculate a person's BMI based on their weight and height using the following formula:

$$BMI(kg/m^2) = \frac{W}{H^2}$$

Where: - W is the weight, in kilograms.
- H is the height in meters.

Then display the corresponding weight status according to the following categories:

- Underweight: BMI less than 18.5
- Normal: BMI from 18.5 to 25
- Overweight: BMI from 25 to 30
- Obese - Should lose weight: BMI from 30 to 40
- Severely Obese – Should lose weight immediately: BMI over 40