

Introduction to Computer Programming

Exercises – Week 8. Computational Modelling and Documentation

Part 1. Expressing algorithms

Exercise 1 - Building Flow Diagrams of Algorithms (Essential)

For each question you should draw a flow chart to represent the process needed to solve the question. You may find it helpful to write out some or all of the steps in chronological order first. You may use software to create the lists and diagrams or write/draw them by hand.

1. Convert temperature from Fahrenheit ($^{\circ}\text{F}$) to Celsius ($^{\circ}\text{C}$) using the formula

$$C = \frac{5}{9} \times (F - 32)$$

where C =temperature in ($^{\circ}\text{C}$) and F = temperature in ($^{\circ}\text{F}$).

2. A student will pass the year if the average score for 5 units is 40% or above. Write a program that can be used to determine if a student passes or fails the year.
3. A bank account has an interest rate of 3%. The interest accrued is calculated at the end of each year. The initial deposit is £200. At the start of each subsequent year, £100 is added to the bank account. Display the interest accrued at the end of each year.
4. A digital thermostat checks the current temperature read by a sensor and compares it to a preset temperature. The heating is switched:
 - ON if temperature lower than the preset temperature
 - OFF if temperature higher than, or same as, the preset temperature

Determine whether the heating should be ON or OFF using the present temperature and the current temperature, and display the outcome.

Exercise 2 - Building more Flow Diagrams of Algorithms (Advanced)

1. Determine the largest in a sequence of numbers and display the outcome.
2. Display the first 10 Fibonacci numbers.
3. Check if a word is in a sentence.

Part 2. Computational Models

Exercise 3 - Translating Algorithms to Code (Essential)

1. For each of the questions in Exercise 1, write a program to execute the steps you have drawn up in the flow diagram.
2. Translate the flow diagram of Euclid's algorithm for computing the greatest common divisor (GCD) [also known as the greatest common factor (GCF) or highest common factor (HCF)] of two positive integers (Figure 1) to a program.

3. Translate the flow diagram of an algorithm to generate a 12 by 12 multiplication table (Figure 2).

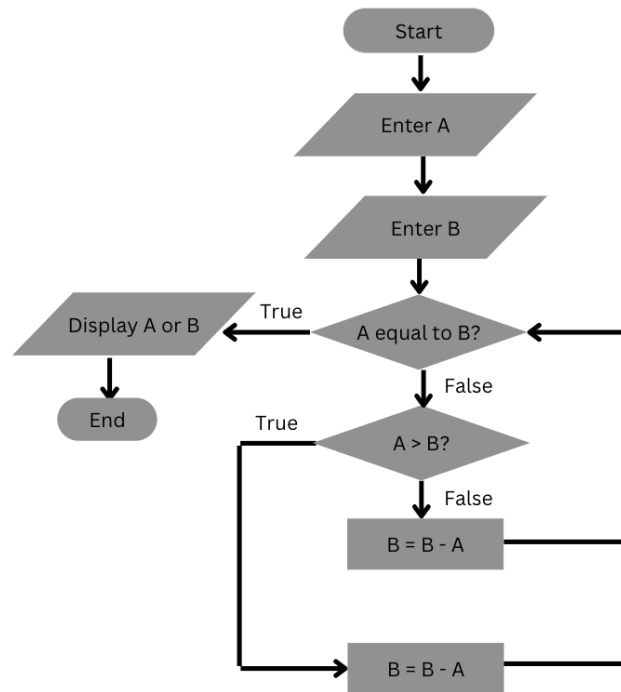


Figure 1: Euclid's algorithm for computing the greatest common divisor (GCD).

Exercise 4 - Translating Algorithms to Code (Advanced)

1. For each of the questions in Exercise 2, write a program to execute the steps you have drawn up in the flow diagram.
2. Translate the flow diagram of an algorithm to sort 3 different numbers a,b,c in descending order.

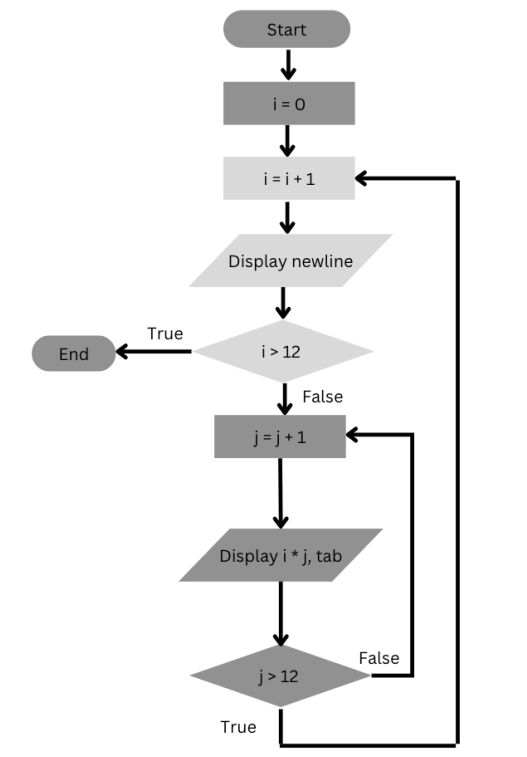


Figure 2: An algorithm to generate a 12 by 12 multiplication table.