

Tutorial: Algorithms, pseudocode and flowcharts

Aim

This aim of this class is to become competent with creating and understanding small programs using flowcharts and pseudocode.

Questions

1. Write down the output for the following flowchart given inputs $a = 4$ and $b = 8$.

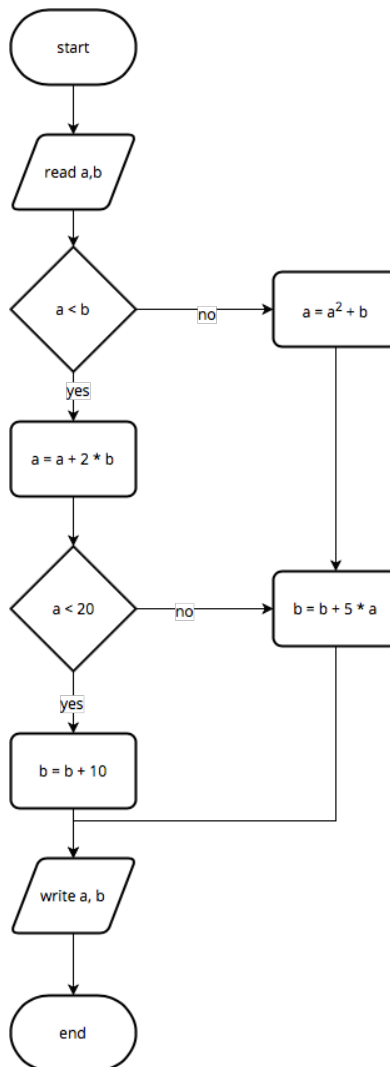


Figure 1: Question 1 Flowchart

2. Draw a flowchart for the following problem:

The tax office is calculating how much tax is payable given a particular salary. If the salary is equal to or less than \$10,000, then the tax payable is 10%. If the salary is between \$10,001 and \$50,000, then the tax is 10% for the first \$10,000 and 20% for any remaining amount above \$10,000. If the salary is greater than \$50,000, then the tax payable is 10% on the first \$10,000, 20% on the next \$40,000 and then 40% on the remaining salary above \$50,000.

3. Draw a flowchart containing a loop of your choice that prints out the first 8 powers of 2 in reverse, e.g.,

128 64 32 16 8 4 2 1

4. Given the flowchart in Q1, write pseudocode for the same task.

5. The factorial of a number is defined as:

$$n! = 1 \times 2 \times 3 \times \cdots \times n \text{ for } n \geq 1$$

Using the three types of loops (enumeration, pre-test and post-test) we have studied, use pseudocode to write three functions that take a positive number n and calculate $n!$

6. Use pseudocode to write an algorithm that finds the smallest number in a list of n numbers

$$x_1, x_2, x_3, \dots, x_n$$

What simple change could be made to find the largest number in the list?

Algorithms: extra questions

1. Draw a flowchart containing a while loop that given N calculate:

a)

$$sum = 1 + \frac{1}{2} + \frac{1}{3} \cdots + \frac{1}{N}$$

b)

$$sum = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} \cdots \pm \frac{1}{N}$$