



Computer Science – Exercises in Computational Thinking

Tasks & Scenarios

Students' version

Complete these tasks for each scenario

tASKS

Complete the following tasks in order to develop an algorithm to solve the problem.

A. ANALYSIS



Analyse the scenario and identify the inputs, processes and outputs needed for the algorithm.

B. FLOW CHART



Represent the algorithm using a flow chart.

C. PSEUDOCODE



Represent the algorithm using pseudocode.



Extension

**Using a suitable programming language, code your solution.
Test the program using suitable data.**

Scenario

George's Greenhouse

Worked Example

George is the caretaker at school, and he has been given a greenhouse to grow plants for the school grounds. He would like to keep the greenhouse at a set temperature so that plants grow quickly; he would like to be able to change the set temperature between 17 °C and 26 °C, depending on what he is growing.

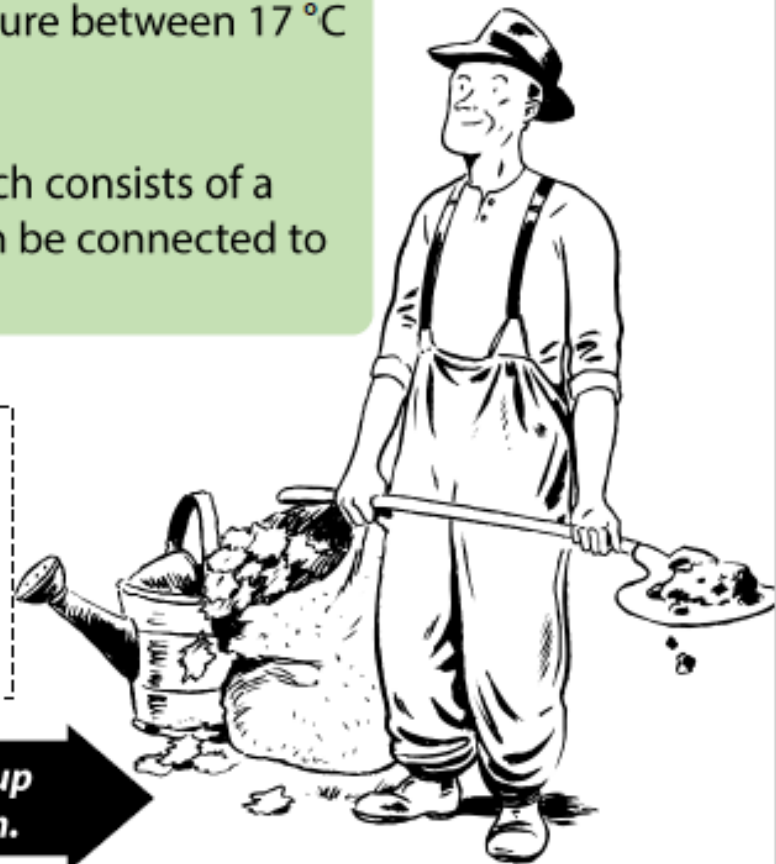
He has bought a greenhouse control kit online, which consists of a heater and a wireless temperature sensor, which can be connected to his computer.

Temperature Sensor Note:

In this case a temperature sensor is a device that will gather data concerning the temperature of the greenhouse, and convert it into a form that can be understood by the computer control system.

your goal

Design an algorithm to help George set up an automatic greenhouse control system.



Scenario

Security Door Code



Loch Doon School plan to install security locks on the computer room doors that are linked to the alarm system.

To open the door, a 4-digit code will have to be inserted using a keypad similar to the one shown in the image on the right. An example of the code could be '1234'.

The code is checked by the system and, if correct, the door will unlock to allow access.

Your Goal

Create an algorithm for the security door code checker.



Scenario

Cassie's Cakes

Cassie runs Flour Power – a small business that caters for parties and she has been asked to bake some special themed cakes for a Hallowe'en party.

She has found a great recipe for Pumpkin Pecan Cupcakes on an American website, but she doesn't understand some of the units that they are using for the ingredients, such as 'cups' rather than 'grams'.

Cassie wants to know the weight of flour and sugar needed in grams so that she can buy the necessary ingredients to bake enough cupcakes for the Hallowe'en party.

She needs the following for the first batch:

- 12 cups of all-purpose flour
- 14 cups of granulated white sugar

She would also like to use the converter program for other recipes.



Measurement hint:

1 cup of all-purpose flour = 128 grams and
1 cup of granulated white sugar = 201 grams



your goal

Create an algorithm to help Cassie calculate the ingredients she needs

Scenario

Carpet Diem Quotation



Walter Wall has just got a job with Carpet Diem Carpets an estimator. He has an idea that a computer program could be used to give him an estimate of the cost to fit a carpet.

Walter thinks it would be a good idea to use a trial program for a basic rectangular-shaped room. Customers are able to choose a carpet from the following price ranges:

Range	Basic	Standard	Luxury
Price (m ²)	£6.50	£18.75	£29.50

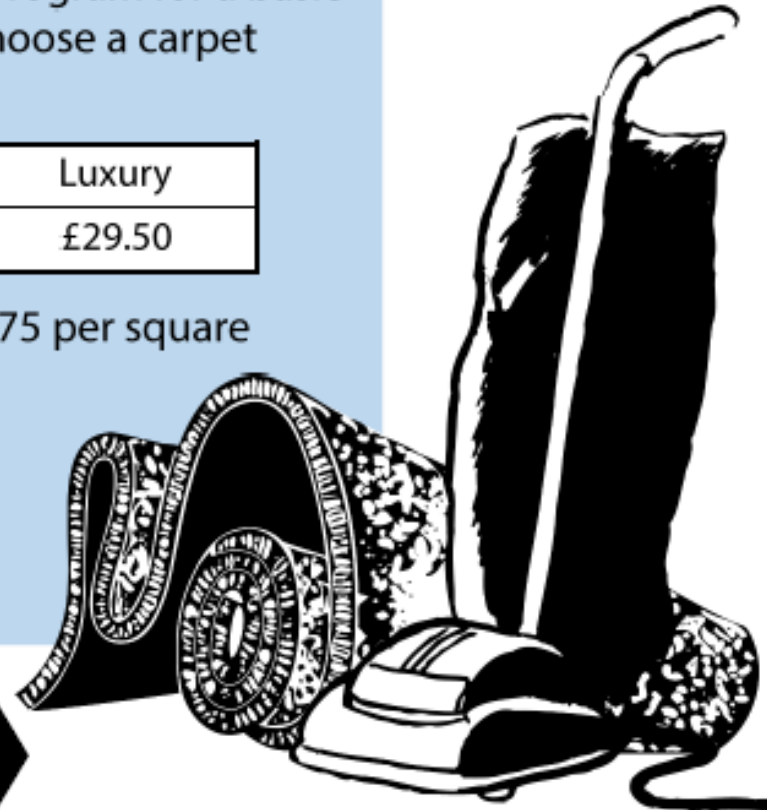
To perform his calculations he normally charges £3.75 per square metre to cover the cost of fitting the carpet.

He also uses the following information:

- Room measurements
- Price of carpet

your goal

Create an algorithm to help Walter calculate the total cost to fit a carpet in a rectangular room.



Scenario

Shoetopia VAT Calculator

★★

Connie Verse operates an online trading business known as Shoetopia; she buys last season's designer high-quality shoes and sells them on an international auction site.

She usually buys her shoes from several countries in Europe that use the euro as their currency, but have different standard rates of value added tax (VAT), and so she would like to work out details of what the actual price of the shoes is before the local standard VAT is added to the price.

This will help her to work out which are the cheapest countries she should use to buy her products. Connie purchases her products in Europe from: France, Portugal, Germany, Spain and Italy.

Note: VAT Rates

The standard VAT rates for the countries used in this problem are: France (20%), Portugal (23%), Germany (19%), Spain (21%) and Italy (22%)

your goal

Create an algorithm so that Connie can work out the actual price of the shoes she purchases in Europe and the amount of tax she pays.



Scenario

Simple Calculator ★★

Paddy O'Lair has just left school and started a small business building driveways and patios. He feels that it would be useful for him to have a simple calculator to help to prepare quick quotations for his customers when he checks out a job.

The calculator he needs for his work would have the following functions:

- Addition
- Subtraction
- Multiplication
- Division
- Squares

Hint: Simple calculator formulae used will be:

Addition $\rightarrow x + y$

Subtraction $\rightarrow x - y$

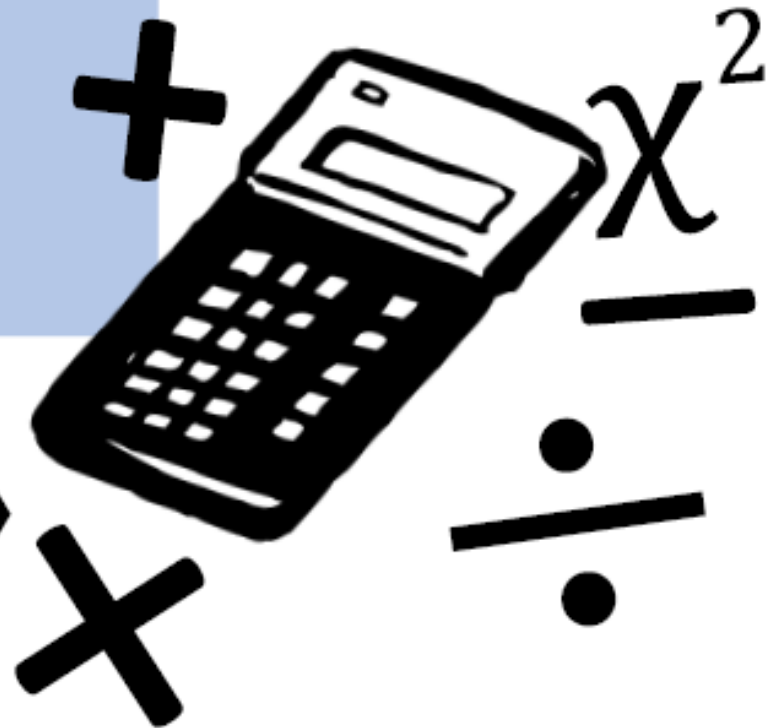
Multiplication $\rightarrow x * y$

Division $\rightarrow x / y$

Square $\rightarrow x * x$

your goal

Create an algorithm so that Paddy has a simple calculator with the functions listed above.



Scenario

Greenfield United Player Performance ★★★

Greenfield United is a sixth-form college football team managed by Max Striker. He is always keen to improve the performance of his players when they first start playing for the club by checking out how well they are playing.

He has an idea to give a score out of 10 for a player's performance in each game, and then to calculate an average for the last 7 games that they have played in. Max can then give the player feedback on their performance, and can also give them further advice if their average performance is not improving.

As a trial Max has collected the following ratings for his goalkeeper, Jason Muscat:

Games	1	2	3	4	5	6	7
Rating	6	5	5.5	6.5	4.5	5	8

Note: The average can be calculated by 'the sum of a list of numbers divided by the size of the list'.



your goal

Create an algorithm to help Max calculate the average player performance rating for any of his players

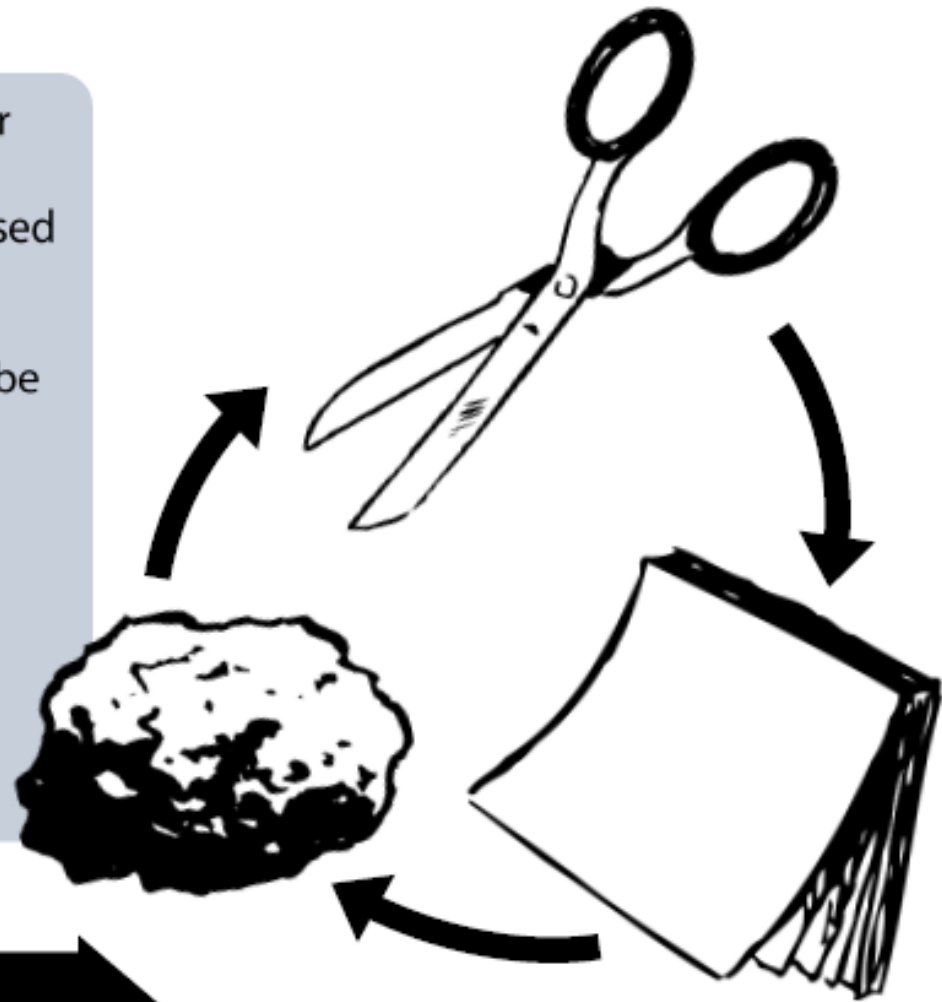
Scenario

Ms Balboa runs an after-school computer studies club and she wants the students to create a simple game based on the rock/paper/scissors idea.

Her initial thoughts are that a game can be produced where the user will play the computer based on the following rules:

- Rock beats scissors
- Scissors beat paper
- Paper beats rock
- If computer and user choose the same, the game is tied

Rock/Paper/Scissors



your goal

**Create an algorithm for the
rock/paper/scissors game**

Scenario

Pedestrian Crossing

★★★★

Mrs Crossman, the head teacher at Valley College, is concerned about student safety as they travel to and from school. She would like the council to install a pedestrian crossing that operates outside the school for the hour before school starts and for an hour at the end of the day.

The pedestrian crossing required uses red, amber and green lights for traffic control; for pedestrian control it uses red and green man symbols with a buzzer that sounds when it is safe for pedestrians to cross the road. There is a button switch which is pressed by the pedestrian when they wish to cross the road.

Mrs Crossman is unsure about the traffic light sequences and timings for pedestrian crossings.

your goal

Create an algorithm to model a pedestrian crossing to demonstrate the sequence and timings to Mrs Crossman.

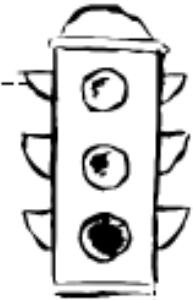
See the next slide for some useful information about traffic lights!



Scenario

Pedestrian Crossing

★★★★



Note: Traffic Light Timings

Traffic light timings can vary depending on how they are set up.

Use the typical digital controller for pedestrian traffic light timings below:

1. Initially, the lights will show a red man to pedestrians and green light to traffic.
2. When the pedestrian wishes to use the crossing, he/she presses a button; the traffic lights immediately turn amber and the pedestrian lights display a red man.
3. After four seconds, the traffic lights turn from amber to red, while the pedestrian lights remain red.
4. After two seconds, the traffic lights remain red, while the pedestrian lights display a green man and the buzzer is sounded.
5. After eight seconds, the pedestrian lights turn to a flashing green man and the buzzer changes pitch.
6. After four seconds the pedestrian lights change to display a red man, the buzzer becomes silent, and at this stage, the traffic lights still remain red with amber light displayed.
7. After a further two seconds, the system is returned to the idle state once again, where the traffic lights are green and the pedestrian lights display the red man.

Scenario

Word Scrambler ★★★★★

Ms McByte is a Computer Studies teacher who runs an after-school club for her students to help them gain experience in the subject. She thinks it would be a useful idea if the students were to create some basic word-type games to improve their analytical and programming skills.

The game she has in mind is based on anagrams; several words are stored in the program with their letters mixed up. When the game starts, a word is chosen randomly and the anagram is displayed for the user to guess the scrambled-up word. The user has three attempts.

Ms McByte thinks it might make the game more interesting if there are three difficulty levels:

- **Basic** using 4-letter words
- **Medium** using 5-letter words
- **Advanced** using 6-letter words



Your Task: **Create an algorithm for the word scrambler game.**

See the next slide for a useful hint!

Scenario

Word Scrambler

★★★★★

Hint: Use the words below initialised as answers and anagrams to test the solution.

		Word 1	Word 2	Word 3	Word 4	Word 5
Basic level	Anagram	WOND	IXTE	LABL	SONE	KOBO
	Word Answer	DOWN	EXIT	BALL	NOSE	BOOK
Medium level	Anagram	ODAIR	EPLXI	RAHIC	GLHIT	SEDIA
	Word Answer	RADIO	PIXEL	CHAIR	LIGHT	IDEAS
Advanced level	Anagram	LOSCOH	WELFOR	YAMDON	SEATSK	KRIBES
	Word Answer	SCHOOL	FLOWER	MONDAY	SKATES	BIKERS

Scenario

Mr String is the Business Studies teacher, and he wants to make a website to share resources with other teachers. He can create most of the website content himself.

He would like to create an online form for the teachers to register, and he notices that on most registration forms the user enters their new password twice; see image of a typical registration form below on the right.

Mr String wants his registration form to check the password has been re-entered correctly, and he wants the password to contain the following features:

- Password length between 8 and 12 characters
- Includes at least one upper-case letter
- Includes at least one lower-case letter
- Includes at least one number

your goal

Create an algorithm for the password checker.

Password Checker

★★★★★

Hint:

Use the standard functions listed in the pseudocode section of this resource to check that the password meets the basic criteria before checking for a match between the password and the re-entered password.



Username:	
Password:	
Re-enter Password:	
Clear Register	