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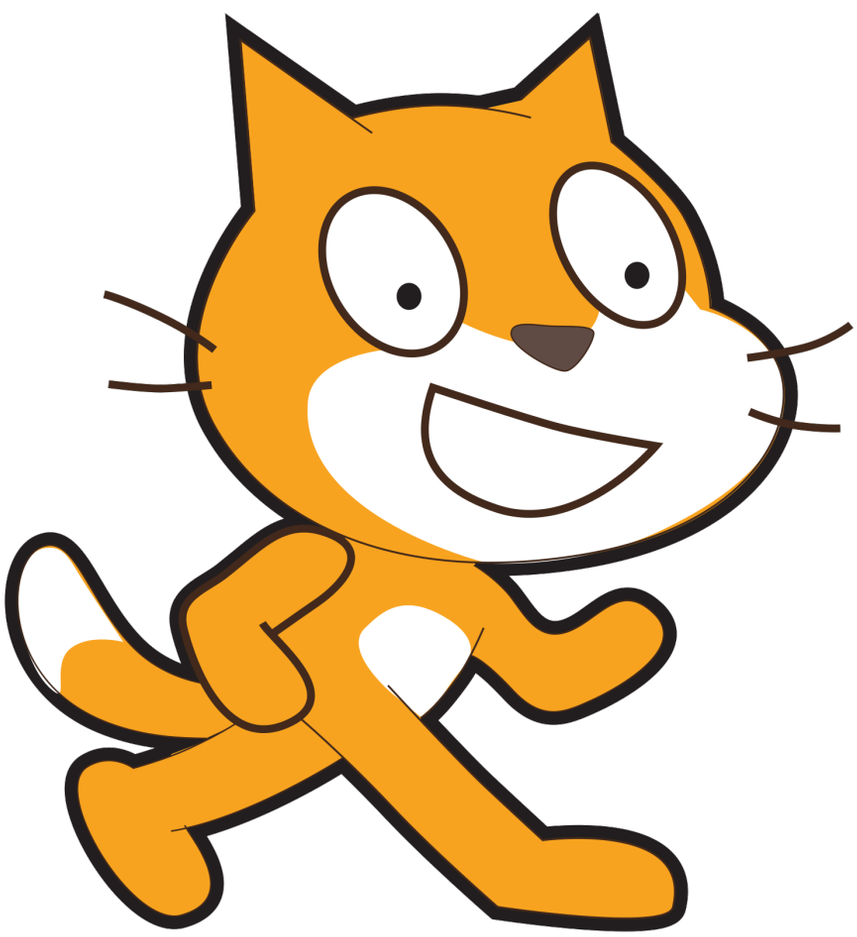
Scratch Programming Tasks



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Unit 4: An Introduction to Programming for Teachers
Technoteach

This Task Book contains tasks that are designed to be completed during the course. You should aim to get all tasks completed. These tasks should develop your understanding of core programming concepts, which will help you not only with Scratch, but with programming in general.

You already have some experience in using Scratch from the previous sessions when creating our Maze games. If not, these can be found in the Resources Folder.

Unit 4 Tasks: 1

- **Task 1.1**

Open Scratch and get a sprite to say “Hello World!” when the green flag is clicked.

- **Task 1.2**

Adjust your code so the character says “Hello World!” when the space key is pressed.

- **Task 1.3**

Add a second character to your game and use a “broadcast” block to get this character to automatically say something in response to the first character. Hint: Remember when using broadcasts, you need to use a block for receiving the message.

- **Challenge Task 1.4**

Get a character to calculate and say the result of the expression:

$$\frac{42 \times 67}{89 - 4}$$

Hint: Remembering the order of operations is key here i.e. BODMAS/BIDMAS/PEMDAS (whichever one is familiar)

- **Challenge Task 1.5**

Get a character to calculate and say the result of the expression:

$$\sqrt{5} \times \sqrt{6}$$

Hint: Can you find a square root function?

Scratch

Unit 4 Tasks: 2 - Variables

- **Task 2.1**

Store your name in a variable called name and store your age in a variable named age.

Get a character to say the following:

My name is <name> and my age is <age>. In 2 years I will be <age + 2>.

Where the angular brackets represent the variables. Hint: You will need to use a combination of “say” and “join” blocks to combine a message with variables.

- **Task 2.2**

Imagine you are writing a piece of software for a shop. You need to calculate prices of items with VAT added. VAT is normally charged at 20% (we ignore the UK’s complex VAT rules and charge all items at 20%).

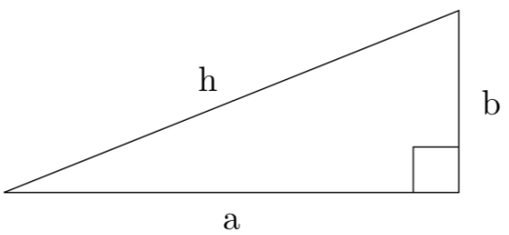
Write a program that:
• allows the user to input the price of an item without VAT
• then displays the price of the item with VAT added.

An example run of the program might be:

Scratch

- **Task 2.3**

Write a program that calculates the length of the hypotenuse of a right-angled triangle:



where a, b and h are the length of the respective sides. h can be calculated as follows:

$$h = \sqrt{a^2 + b^2}$$

Hint: You will need to ask for two separate inputs for this problem. You will also need to think about how to square a number when there is no function to do so in Scratch.

- **Challenge Task 2.4**

Write a program that prompts the user to enter a temperature in degrees Celsius (C) and then converts this to degrees Fahrenheit (F). Hint: To convert the temperature in degrees Celsius to degrees Fahrenheit use the following equation:

$$[^\circ F] = ([^\circ C] \times 9/5) + 32$$

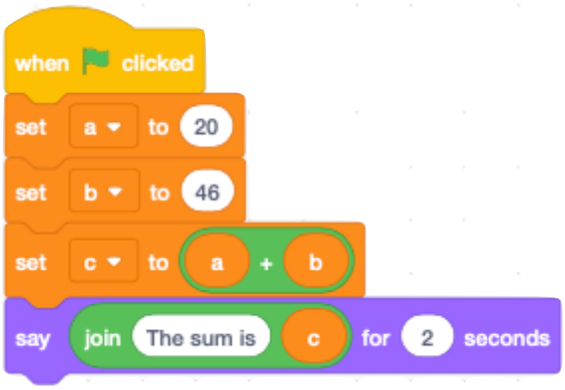
Scratch

Unit 4 Tasks: 3

- **Task 3.1**

Take a look at the following Scratch code:

Modify the code to sum up the values 20, 46 and 18.



- **Task 3.2**

Write a program that asks the user the following questions:

- What is your name?
- What is your neighbour's name?
- What colour is your neighbour's hair?

Your program should store the user's answers in variables. Next, the program should say the following:

Hello <Your Name>.

Your neighbour is <Neighbour's Name> and has <Colour> hair.

For this task you should only use **one** "say" block.

- **Task 3.3**

Write a program that prompts the user for two integers and then calculates:

- The sum.
- The difference.
- The product. (The numbers multiplied together)
- The average.
- The distance (the absolute value of the difference). Hint: There's a function for doing this.

Scratch

Unit 4 Tasks: 3

- **Task 3.4**

Write a program that calculates the weekly cost of sweets for a pupil. Your program should ask the user for the price per sweet and how many sweets they have purchased that week. The program should then calculate the total cost of the sweets.

For this task you should display the final cost to 2 decimal places.

Scratch Tip: In order to display a value to 2 decimal points, this line of code is a quick trick for doing so:

It takes a decimal number Price, multiplies it by 100, then rounds it to get rid of any remaining decimal places, and then divides it back by 100 to give the original number, but rounded to 2 decimal places.

- **Challenge Task 3.5**
  Write a program that prompts the user for a radius of a circle and then displays the area and circumference of a circle with that radius.

Hint: Use 3.14 for pi in this task.

Unit 4 Tasks: 4 - If Else Statements

- **Task 4.1**

Write a program to check if you are old enough to drive. The program should ask for the user's age in years, and output whether they are old enough to get a driving licence (in the UK).

- **Task 4.2**

Write a program which asks for the name of your lecturer. If the name is "Liam" then the program should display "Liam is wearing a t-shirt". If the name is not "Liam" then it should display "<lecturer name> is wearing a formal shirt".

Considerations: Does Scratch care about upper-case and lower-case, is it case-sensitive? How could you test this?

- **Task 4.3**

Write a program which can convert Pounds to Euros, and vice versa. Upon running the program the user should be asked if they wish to perform option 1 of converting Pounds to Euros; or option 2 of converting Euros to Pounds. After making this choice, the user should be prompted with a suitable text to input an amount. The program should then output the converted amount.

The current conversion rates are:

1 Pound is 1.25 Euros.
1 Euro is 0.80 Pounds.

- **Challenge Task 4.4**

Change Task 4.3 (copy the file first) so that instead of using fixed conversion rates, prompt the user to input "today's rate" which is then used in the calculations.

- **Challenge Task 4.5**

Write a program which asks the user for the wind speed in miles per hour and converts it to text according to the following table (which is a simplified version of the Modern Beaufort Scale):

Wind Speed	Output
< 1 mph	Calm
>= 1 and < 12 mph	Gentle breeze
>= 12 and < 30 mph	Strong breeze
>= 30 and < 46 mph	Gale
>= 46 and < 63 mph	Storm
>= 63 and < 74 mph	Violent storm
>= 74 mph	Hurricane force

Unit 4 Tasks: 5 - Loops and Lists

- **Task 5.1**

Write a program which inserts the sequence 1, 2, 3, . . . , 9, 10 in a list, using a repeat.

Hint: Use a repeat loop with a counter/count variable.

- **Task 5.2**

Write a program which inserts the sequence 10, 9, 8, . . . , 2, 1, 0 in a list, using a repeat.

- **Task 5.3**

Write a program which prints the sum of numbers from 0 to 10 (inclusive) using a repeat.

Hint: You need a variable to keep a running total.

- **Task 5.4**

Write a program which prompts the user to enter ten numbers. Once the user has entered all ten numbers the program should calculate the average of them (i.e., the sum divided by the count).

Hint: Keep a running total in a repeat loop. You should only have one “ask” block..

- **Challenge Task 5.5**

Modify Task 5.4 (copy it first) so that the user can enter as many numbers as they wish. The user should indicate they have entered enough numbers by entering -1 (this value should not be considered for the calculation of the average).

Unit 4 Tasks: 6 - Loops Continued

- **Task 6.1**

Write a program which asks the user to enter 10 integers (one after another). Once the user has typed the last integer the program should output the largest of the integers that was entered.

Hint: You should use a repeat which loops 10 times. Each time through the loop the user should enter a number and the program should use an if statement to keep track of the largest number.

- **Task 6.2**

Write a program which asks the user to enter a series of positive integers. The program should keep asking for integers until the user types the integer -1. Once the user has typed -1 the program should output both the smallest and the largest integers that were entered (ignoring the -1).

Hint: You need a "repeat until" block which is terminated with the sentinel value -1. Within the loop you need to keep track of the smallest and largest numbers entered so far.

- **Task 6.3**

Write a program which asks the user to enter a single word. The program should output the number of vowels in the string.

Hint: Loop over the string, inspecting each character as you go. If the character is a vowel then increment a counter. Once you have looped over the entire word, then you can exit the loop and print the value of the counter.

- **Challenge Task 6.4**

Write a program which asks the user to enter a series of sentences. The program should keep asking for sentences until user types "" (the empty string, i.e., they just press enter). Once the user has typed "" the program should output the total number of vowels that were entered.

Hint: You will need a "nested" (loop within a loop) loop (which we have not yet covered).

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Unit 4 Tasks: 7 - Loops continued

- **Task 7.1**

Write a program which prompts the user for some positive integer n. The program should then insert all the **even** numbers up to n into a list.

- **Task 7.2**

Write a program which simulates tossing a coin 10 times. You can do this by having a loop which:

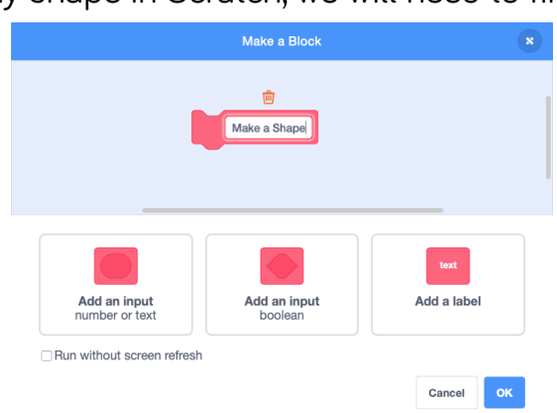
1. Generates either a zero or a 1 randomly, i.e., picks a random integer between 0 and 1.

2. If the number is 0, then adds “Heads” to a list, if the number is 1 then adds “Tails” to the list.

Functions:

One of the most complex ideas we will encounter in Scratch is creating our own functions, much like we did in LOGO. However, functions can also be one of the most useful tools in programming.

To create a new function we find the “Make a block” in the More Blocks category. To make a function that can draw any shape in Scratch, we will need to first of all name the function.



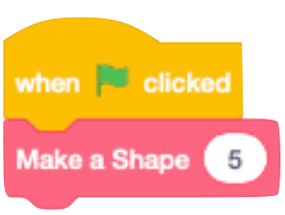
Now we’ve named it, we need to tell it what variables we will need to enter into our function. Click on “add an input”. Then name this input “sides”. This will allow us to enter the number of sides of the shape for our function to draw whenever we want to use the function. Click OK and you will see our new define block is placed.

Functions - Continued:

Now that we have created the block, we need to define what we want the function to do.

We do this by adding the blocks to the define block. First to get the pen blocks to show, you must click add extension in the bottom left corner and select pen. So just like we did in LOGO, we first need to make sure the pen is down, and optionally to clear the screen first of the previous shapes. We then need to move forward an amount (100 works well) and turn a certain amount: 360/sides. We then repeat this as many times as there are sides. The code would look like this. (You can drag the sides block from the define block at the top and insert it where you'd like.

Now in order to use the function all we have to do is tell the programme when to run the function i.e. When the green flag is pressed, or when a key is pressed etc. Then add our make a shape block:



What shape would this make?

Challenge: How would you edit this programme so when the number keys are pressed i.e. 3 - 9, the programme makes a shape with that many sides? So if the user presses the "3" key, a triangle is drawn, if "4" key, a square is drawn.

- **Unit 4 Tasks: 8 - Functions**

- **Task 8.1**

Write a function which takes as a parameter the radius of a circle. The function should compute and return the area of a circle with that radius. Note: the area of a circle with radius r is calculated as follows:

$$\text{Area} = \pi \times r^2$$

Call your function (several times) at the bottom of your source code to test that it works.

Hint: Use 3.14 as pi.

- **Task 8.2**

Write a function which takes a word or sentence as a parameter. Your function should return the number of vowels in the word or sentence.

Call your function (several times) to test that it works.

Hint: We've already done a similar programme before!