

Developing Maths through Scratch

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Author code-it.co.uk resources

Author How to teach Primary Programming using Scratch

Scratch Overview

- Programming Language Since 2007
- Two versions 1.4 & 2.0
 - Pyonkee (iPad version of Scratch 1.4)
- Online & Offline
- User Community
- Used from Y3 to Undergraduate Study
- Block based rather than text based
- Limitations

Computational Thinking & Scratch

- Algorithms
- Algorithm Evaluation
- Decomposition
- Generalisation
- Abstraction

Example Question

What is 3x3?

After a count of 3 all shout out
your answer

1 2 3

If you shouted 9 then well done
and give yourself a point.

If you shouted anything else you
are wrong and receive no points.

Algorithm

Think of a question

Think of the answer

Ask the question

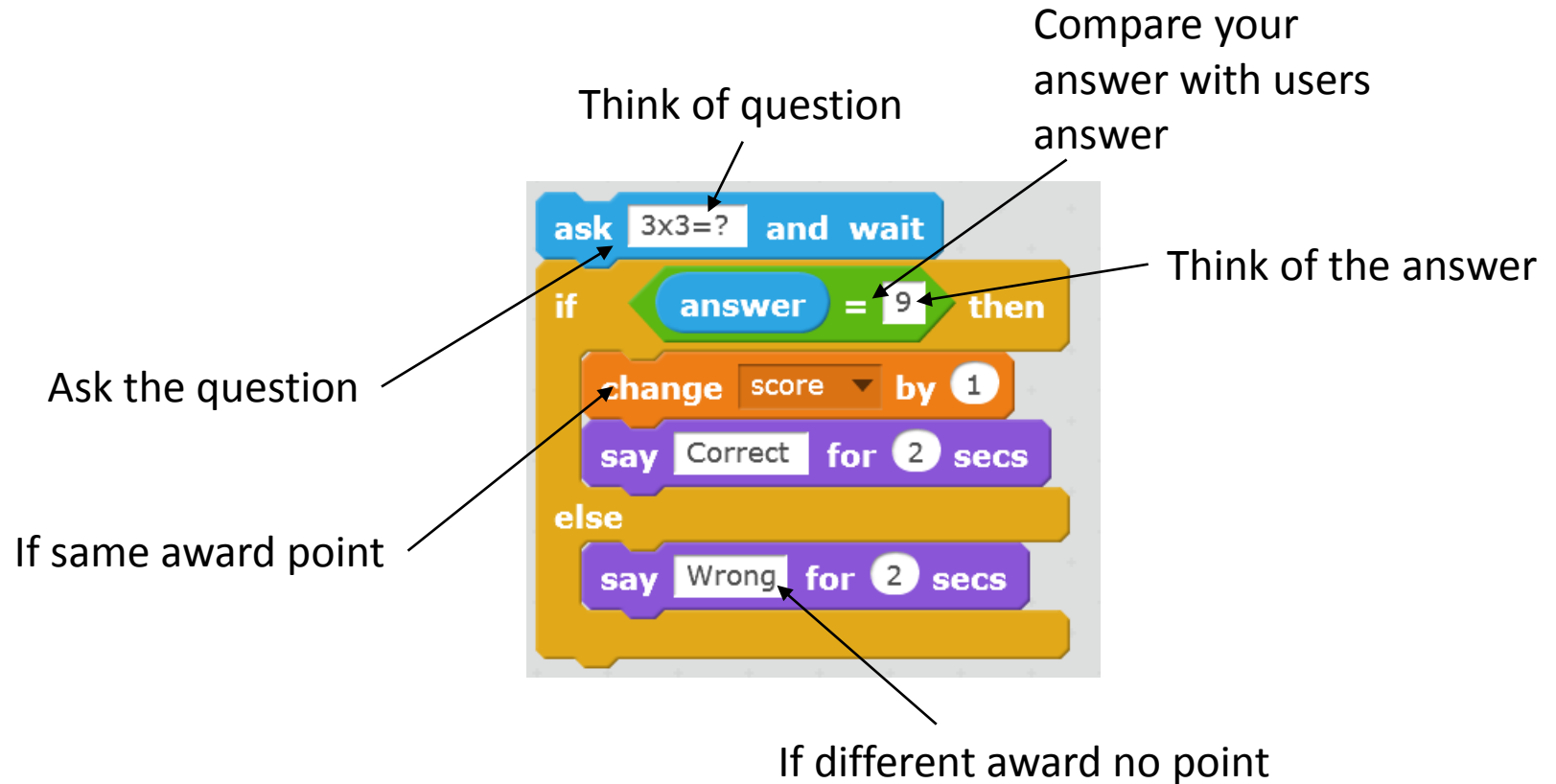
Compare your answer with
users answer

If same award point

If different award no point

All programming is an algorithm turned into code.

Turning Algorithm into Code



All programming is an algorithm turned into code.

Generalisation

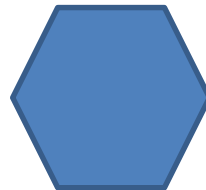
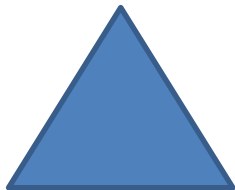
Adapting a solution that solved one problem to solve another.

```
when a key pressed
pen down
repeat 3
  move 100 steps
  turn 120 degrees
pen up
```

```
when b key pressed
pen down
repeat 4
  move 100 steps
  turn 90 degrees
pen up
```

```
when c key pressed
pen down
repeat 6
  move 100 steps
  turn  $360 / 6$  degrees
pen up
```

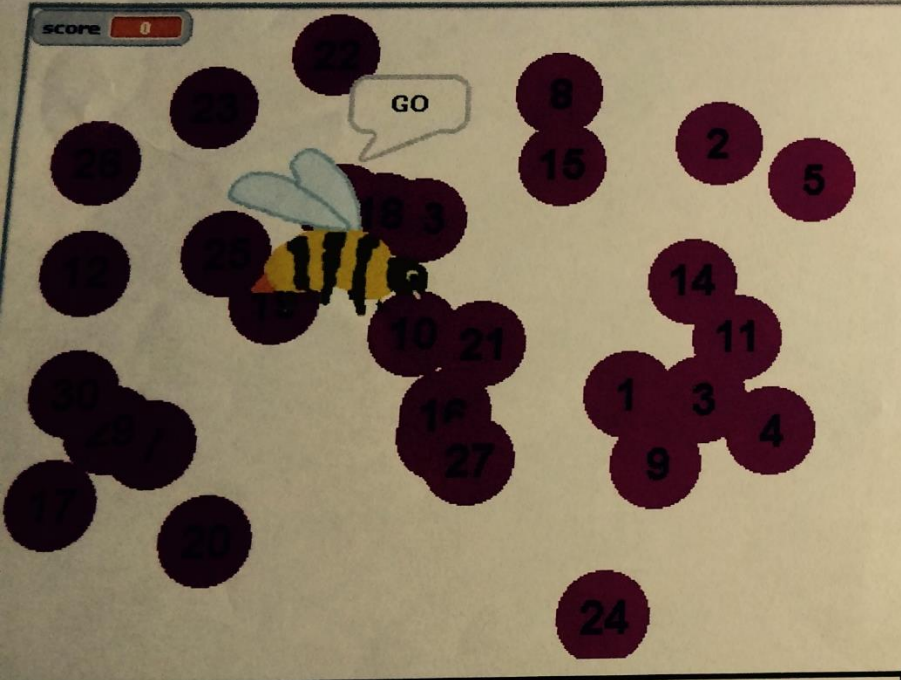
```
when d key pressed
pen down
ask "How many sides?" and wait
repeat answer
  move 100 steps
  turn  $360 / \text{answer}$  degrees
pen up
```



What do you need to make?

Number sprites
Say block
Bee sprite

move block
Score block
Turner block



Times Tables Game Algorithm

name Sophia

What do you need to make all the number sprites do?

You need to make sprites disappear when kicked. Make them move. Only number which are right + a point if wrong - a point. Say then disappear then come back and tell score

What do you need to make only the correct numbered

sprites do? Add a point when they kick on a number in the 2x tables. Subtract a point each time they kick on a wrong.

What do you need to make only the wrong numbered sprites

do? when the kick on a wrong answer subtract 1 point

What do you need to make the start (bee) sprite do?

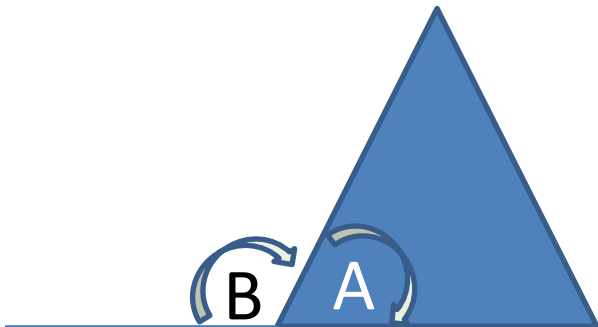
When you finish a game reappear because of there set to hide.

The says what is programmed to do then reappear after game with points

Examples of programming decomposition

Incidental Maths

- Angles (Smoking Car)
- Percentages
- Decimal Fractions (Music Machine)
- = Same as (Maths Quiz)



Maths Related Projects

- Training Computer to do Maths
- Maths Quiz
- **Counting Machine**
- Coin Program
- Times Table Game
- Perimeter Program
- Angle Sorter
- **Cartesian Coordinates**
- Clock

Planning can be found here

<http://code-it.co.uk/scratch/scratchplan>

However latest version is here

<http://www.amazon.co.uk/Teach-Primary-Programming-Using-Scratch/dp/1908684534>

Counting Machine

Module Aim: Create and adapt a counting machine.

Module Learning Focus

By the end of the module children will be able to:

- Solve simple maths problems using Scratch code
- Understand the benefit of changing a variable within a loop
- Investigate and modify a simple program that changes a variable
- Begin to look for ways to generalise this idea elsewhere

Computer Science Concepts:

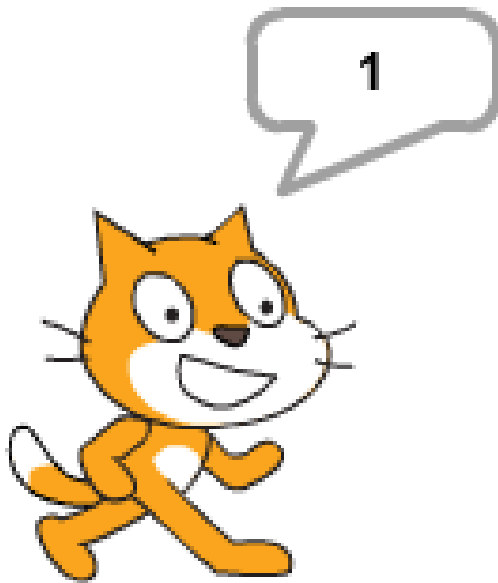
- Repeat x times loops
- Variables in a loop
- Reporting a variable by using it within a say command

Maths Concepts

- Counting in multiples, counting backwards, counting in halves, counting in tenths, counting in hundredths, counting from a different starting number

Counting Machine

Can you get the cat to count?

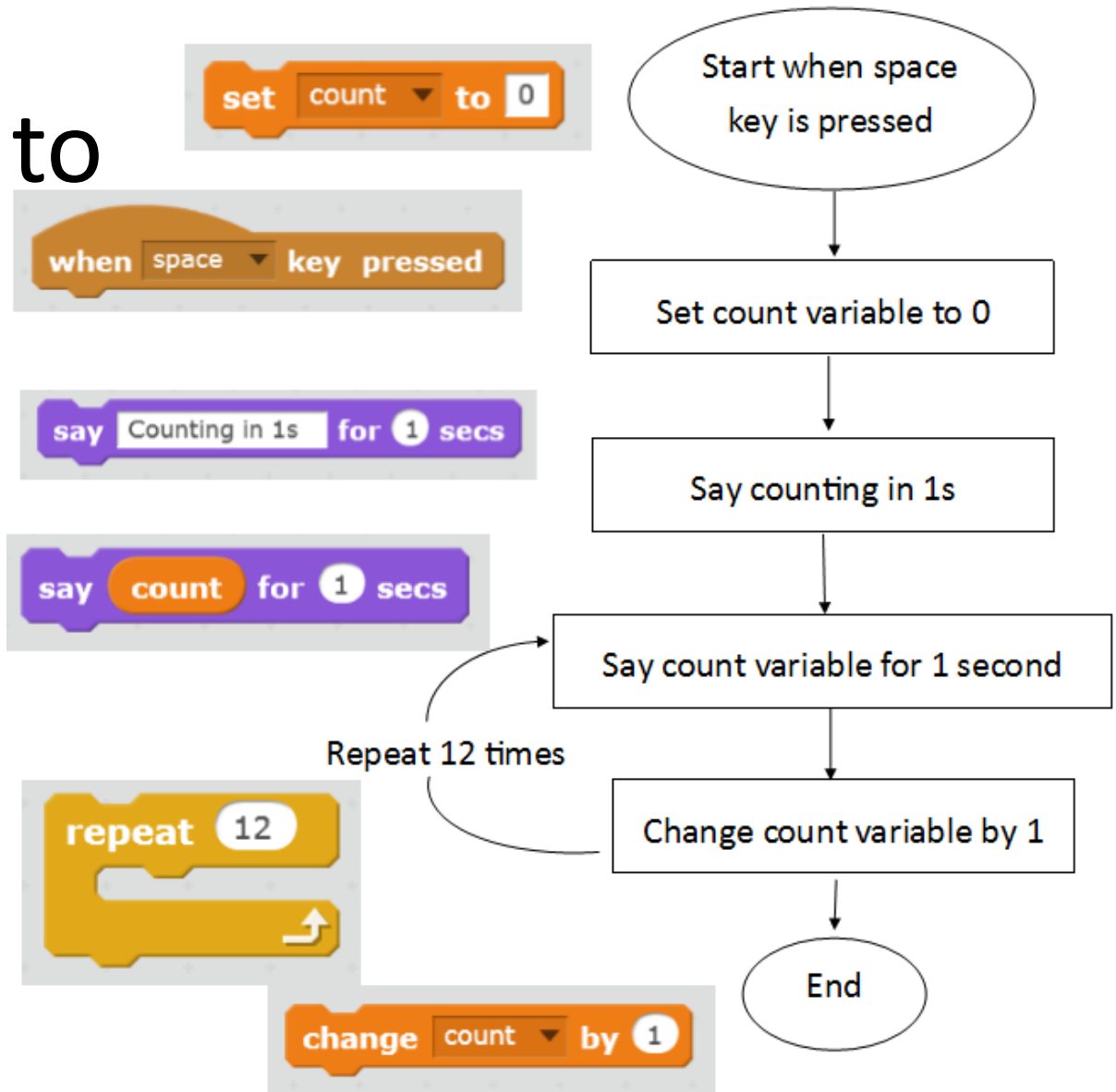


Modelling a better solution



https://youtu.be/_26bc5twFRg

From Algorithm to Code



Which two blocks go inside the repeat loop?

Counting Machine Challenges

- Can you count faster?
- Can you count in multiples of 7?
- Can you count backwards?
- Can you count in tenths or hundredths?
- Can you start from 30 and count down to 0?
- Can the user say how long they want the countdown timer to last for?