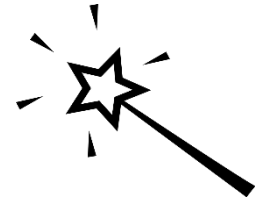


Algorithm Magic



Age range: Year5/6

Learning Objectives:

Test and debug instructions for a specific purpose

Understand that instructions in an algorithm must be precise and have only one outcome

Pupils could work in pairs

Resources: Fruit picture and Algorithm Magic Debug recording sheet

Algorithms are central to computing and how we get computers to solve problems. Algorithms are precise sets of instructions for a predefined outcome. An algorithm's instructions must be so precise that when followed the algorithm will always give the same result.

Computer Scientists make great magicians because algorithms can help us do magic tricks.

Try the following piece of magic. Tell pupils that you are going to make them all think of the same fruit.

Give the following instructions

- *Think of a number.*
- *Multiply the number by 9.*
- *Add its digits together.*
- *If more than one digit add the digits together again.*
- *Keep on going until you have a single digit.*
- *When you have a single digit take away 5.*
- *Using A=1, B=2 etc. change your number to a letter.*
- *Think of a country that begins with that letter.*
- *Think of an animal that begins with the last letter of the country.*
- *Think of a fruit that begins with the last letter of the animal.*

Now wow your pupils by holding up the picture of the orange and claim that your magic algorithm worked!

Now wait for someone to say that their fruit was actually an apple! Oh dear the trick has failed. It has failed because our algorithm has bugs in it. In this case, imprecise instructions that allow numerous possible answers.

Ask pupils to debug the algorithm by testing whether each instruction is precise enough to give only one possible answer.

Your pupils will discover that the first part of the algorithm is fine. Regardless of what number you begin with you will always end up with 4. If you convert your number to its positional letter in the alphabet you'll get D. So far so good.

However, for the trick to work pupils must choose Denmark as their country beginning with D, then choose kangaroo as their animal beginning with K. This means that the answer is therefore a fruit beginning with O – an orange.

But this magic trick is not fool proof. There are other possible answers because this is not a precise enough set of instructions.

Ask pupils to use atlases (or Google) to find out how many other countries begin with 'D' (There are six) and how many animals begin with 'K' (at least 20)

Can they now think of instructions that are so precise that the only possible answers would be Denmark, kangaroo and orange? Use the Algorithm Magic Debug recording sheet

Rewrite the algorithm with precise instructions so that the magic trick never fails.

Algorithm Magic Debug recording sheet

| Instruction | Outcome 1 | Outcome 2 | Outcome 2 |
|---|-----------|-----------|-----------|
| Think of a number | | | |
| X 9 | | | |
| Add the digits together | | | |
| If double digit answer repeat until single digit answer | | | |
| +5 | | | |
| | | | |

Countries beginning with D

Animals beginning with K

Fruit beginning with O

Replace 'think of a country beginning with 'D' with a more precise instruction that will only give the answer 'Denmark'

Replace '*think of an animal that begins with the last letter of the country.*' with a more precise instruction that will only give the answer kangaroo

Replace '*think of a fruit that begins with the last letter of the animal*' with a more precise instruction that will only give the answer orange

Test your refined algorithm on your friends – does the trick always work now?

