

VCE Algorithmics Head Start 2104: What is an Algorithm?

Aims:

- Know what an algorithm is
- Know the relationship between a computer program and an algorithm
- Be introduced to visual programming with Snapapps (in this case, Scribble)

Resources:

- Copy of pages 37 - 61 of “Algorithmic Adventures: From Knowledge to Magic” by Juraj Hromkovic (Springer: 2009).
- If unfamiliar with Scribble, copy of tutorial:
https://www.dropbox.com/s/0rz8my0ck5ut0kl/Scribble_tutorial_polygons.pdf?dl=0
- The Scribble online programming environment:
<http://aidanlane.github.io/snapapps/scribble.html>
- XML files in this folder

Algorithmic cooking

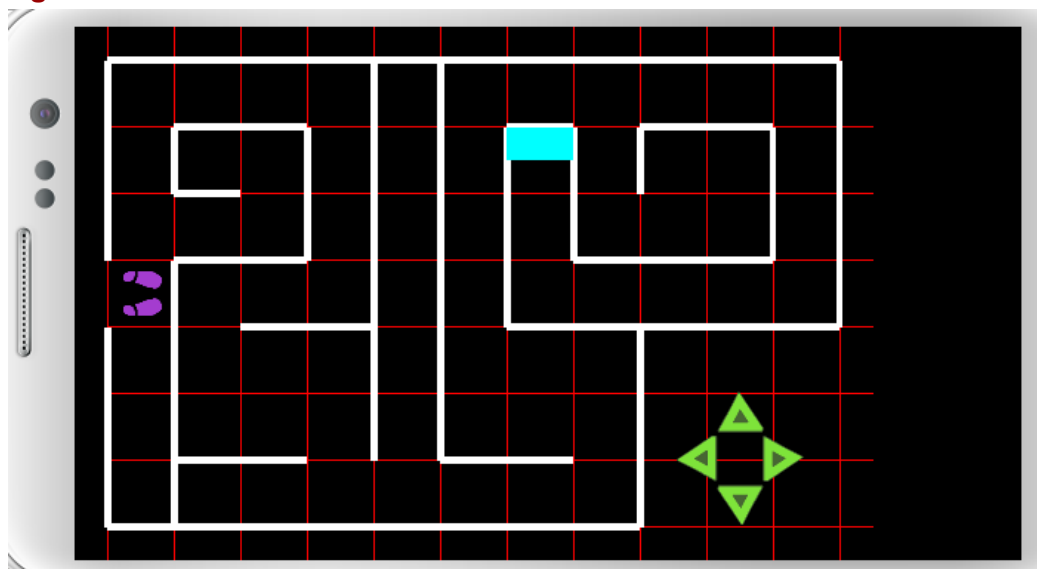
Base your answers to the questions in this section on pp. 37 - 44 of the handout. Also feel free to add any other notes:

Define an algorithm:

In what way was the recipe for an apricot flan NOT an algorithm?

As you read, compile a list of requirements for a set of instructions to qualify as an algorithm:

Here's a maze (from the Avila APP Group's upcoming game, Help Annie). Write an algorithm that would lead the feet to the blue finish line:



Computer algorithms

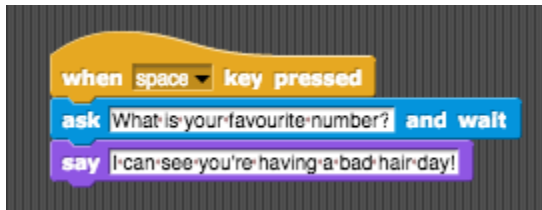
As you read section 2.3 of the handout, keep going back and adding to the list of “requirements for algorithms”.

Is this a valid description of an algorithm for solving quadratic equations? Explain:

1. Read inputs: a, b, c
2. Calculate first output: $x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$
3. Calculate second output: $x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$
4. Output: x_1 and x_2

Define programming:

In what way is the following program not an implementation of an algorithm?



Exercises

Attempt exercise 2.3 and then take a look at this video explanation

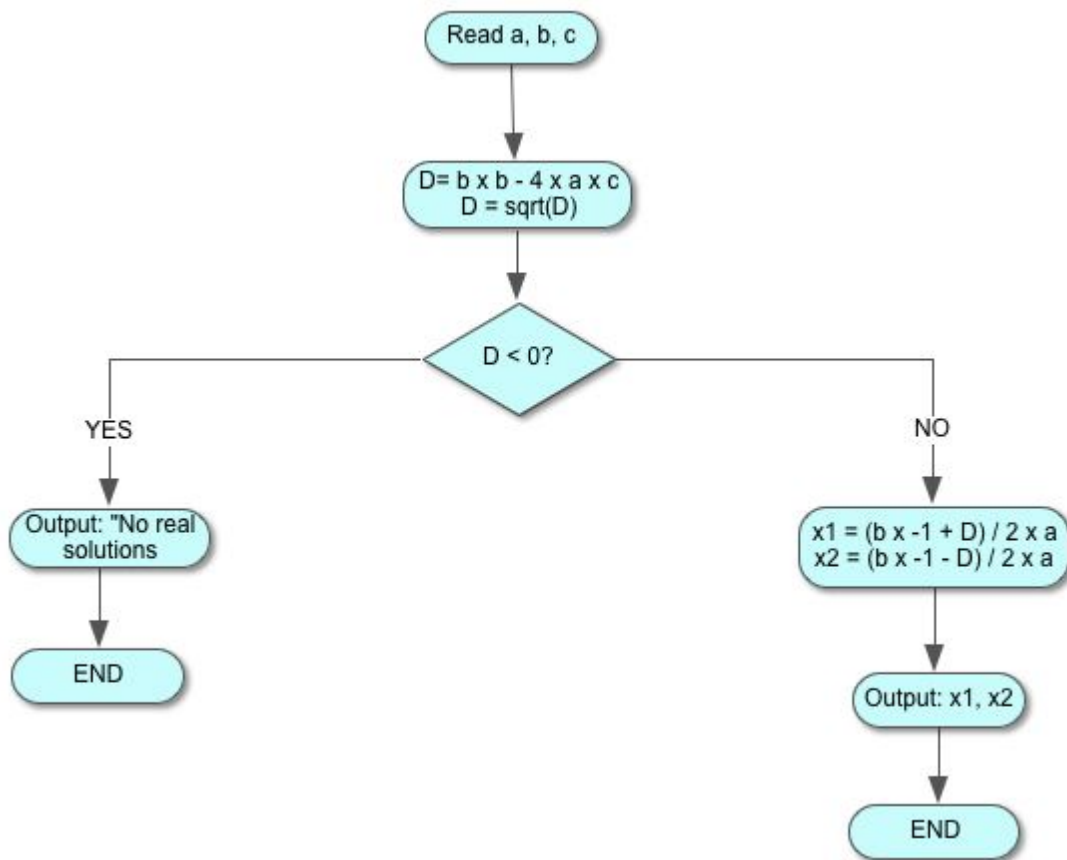
<http://vimeo.com/album/3113929/video/110843368>

Use this table to help you solve exercise 2.4

Register	Reg(7) ← Reg(1) + Reg (7)	Reg(3) ← 101	Reg(3) ← Reg(3) + Reg(3)	Reg(3) ← Reg(7) + Reg(3)
0	7			
1	1			
2	2			
3	3			
4	4			
5	5			
6	0			
7	1 + 5 = 6			

Complete Exercise 2.5 and then use it to write an algorithm that computes the length of the hypotenuse, given the lengths of the 2 shorter sides.

The flowchart below shows an algorithm for solving quadratic equations. Can you spot the mistake?

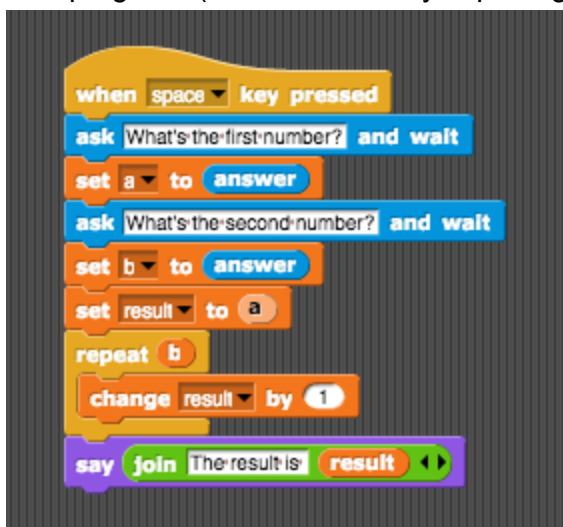


What do these programs accomplish / What is the goal of the algorithms?

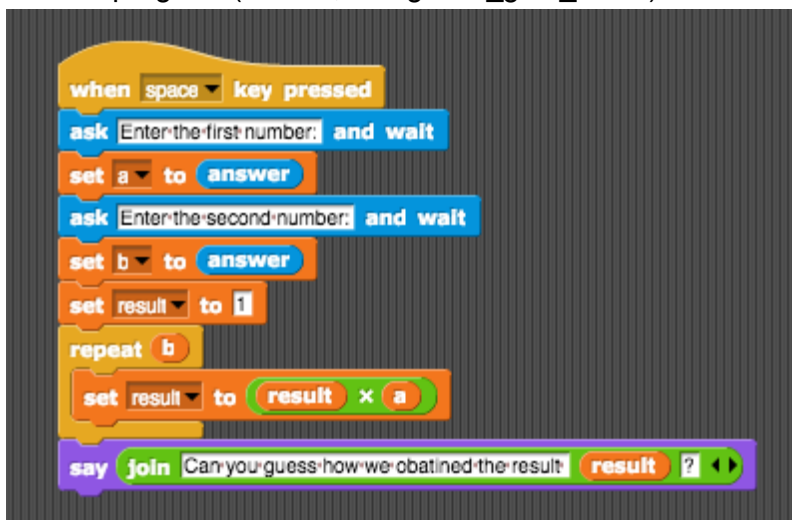
First algorithm:

```
Read integer a
 $i \leftarrow 0$ 
result  $\leftarrow 0$ 
repeat until  $i = a$ :
    result  $\leftarrow$  result + a
end of repeat
Output result
```

First program: (You can test it by importing guess_goal_3.xml into Scribble)



Second program (To test, use guess_goal_4.xml):



Second algorithm:

Read positive integers a, b

while a \neq b:

if a > b then:

a \leftarrow a - b

else:

b \leftarrow b - a

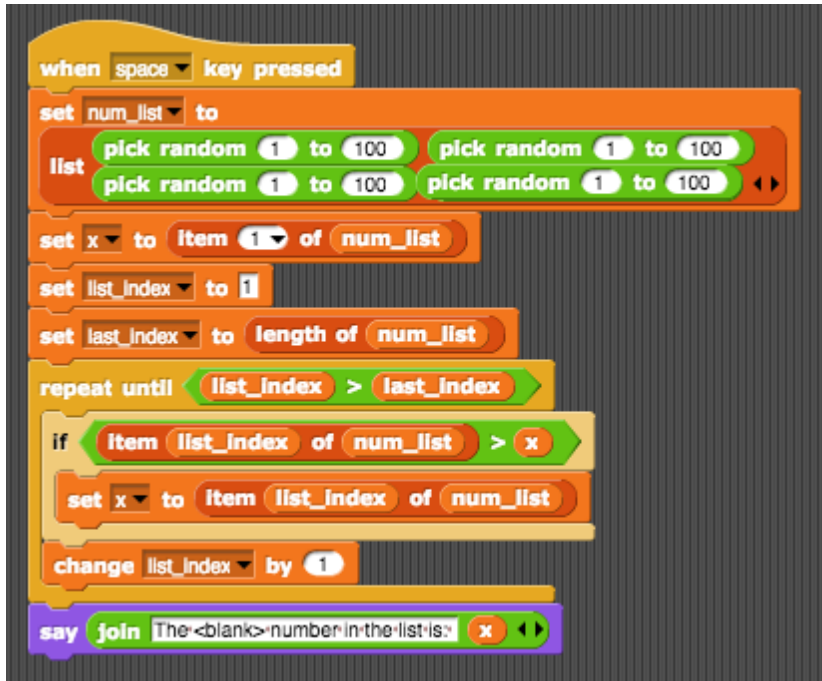
end of while

Output a

Third program (To test, use guess_goal_2.xml):

The image shows a Scratch script for a number guessing game. The script starts with a 'when space key pressed' event. It initializes 'sum' to 0, 'num_list' to an empty list, and 'counter' to 1. A 'repeat until' loop runs 100 times, inserting 'counter' at 'counter' of 'num_list' and incrementing 'counter' by 1. Then, 'counter' is set to 3, and another 'repeat until' loop runs 100 times, changing 'sum' by 'Item counter of num_list', replacing 'Item counter of num_list' with 0, and incrementing 'counter' by 3. Finally, 'counter' is set to 5, and a third 'repeat until' loop runs 100 times, changing 'sum' by 'Item counter of num_list', replacing 'Item counter of num_list' with 0, and incrementing 'counter' by 5. Two yellow callout boxes provide instructions: 'Populate the list so that at each position, p, it contains the number p (same as position)' and 'Guess what we're doing from here onwards.'

Fourth program (To test, use guess_goal_1.xml):



Programming assignment:

1. From the handout, complete Exercises 2.9, 2.10, 2.11 as programs in Scribble.
2. Write a program that calculates the lowest common multiple of two positive integers
3. CHALLENGE (optional): Write a program that uses the sieve of Eratosthenes to find the prime numbers up to 100 (See: http://en.wikipedia.org/wiki/Sieve_of_Eratosthenes)