Algorithm Development

Computer Science Inside…

What is the similarity between these?

- Cooking recipe
- Downloading software or music
- Car repair manual
- Setting up a music playlist
- Knitting pattern
- Calling a friend on the phone
- Sheet music

What written instructions have you followed…?

- …to complete a task?
  - Can you give an example?
- Were the instructions easy or difficult to follow?
  - Why? What made them easy/ hard?
    - They made sense?
    - You couldn't understand them?
    - They didn't give you enough information?

Why discuss lists of instructions here??

- Computer programs are lists of instructions
  - with very particular characteristics
  - known as *algorithms*
- How many of you know of a famous computer error/mistake?
- These are caused by the *wrong instructions* in the program
  - the instructions were interpreted by the computer in a way not intended by the program designer
- We are going to explore how these errors come about

Following an Algorithm

- Algorithm written on hand-out
  - to draw a picture

- You cannot ask for any help
- Don't look at your classmates work
  - do it by yourself!!!

Here's the algorithm – follow *exactly!!*

1. Draw a diagonal line
2. Draw another diagonal line connected to the top of the first one
3. Draw a straight line from the point where the diagonal lines meet
4. Draw a horizontal line over the straight line
5. At the bottom of the straight line, draw a curvy line
6. Draw a diagonal line from the bottom of the first diagonal to the straight line
7. Draw a diagonal line from the bottom of the second diagonal to the straight line

How did the pictures turn out?

- Compare your picture with others' pictures…
  - Were they different?
  - Why?
  - What was difficult about following the instructions
  - What was missing from the instructions?

RESULTS

- Let's look at your results.

Putting all this together…

- This time:
  - write an Algorithm
  - test it yourself
  - get someone else to try it out…
- Can you be sure your algorithm will work ok?

Write & test your algorithm

- The task/problem:
  - make a shape out of paper – one sheet of A4
- Write the *algorithm*
  - Write a set of instructions that explains how to make a paper shape from 1 sheet of A4 paper
- Test it
  - Try out your algorithm – does it work?
  - Note: follow your instructions *as closely as possible*
  - Adjust the instructions if necessary

Following an algorithm

- Hide your shape
- Get into pairs
  - by teaming up with someone ***on the opposite side of the room***
  - move to sit together
  - *Do not* show them your paper shape – hide it!!
- Swap algorithm/instructions with your partner
- Follow your partner's instructions to create their paper shape
- Compare shapes
  - how similar is each 'pair' of shapes?
  - what advice can you give on how to improve the instructions?

What do we know about algorithms?

- What are the key characteristics of a "good" algorithm? Why are they hard to develop?
  - Must be unambiguous
  - Must be correct
  - Must be at the right level of detail
- Also, what did we learn about problems we pick?
  - too large sometimes?

Algorithms are fundamental…

- …to Computer Science, and to society
  - Our electronic devices are teeming with algorithms realised in programming code
  - You perform them *every day, every hour*…
- First algorithms developed by the Greeks
  - e.g. Euclidean algorithm for finding greatest common divisor
- "Algorithm" comes from Al Khwarizmi – Persian astronomer and mathematician

Some activities are not *algorithmic* in nature

- Problem solving
- Human thinking process
- Falling in love
- and so on…

- That is why some might think of these are *hard…!!*

- When we can express the human thinking process as an algorithm, Artificial Intelligence will have truly been created

Conclusions

- Algorithm
  - step-by-step method for accomplishing a task
- Following an algorithm
  - relatively easy
- Finding/designing Algorithms
  - difficult but exciting and fulfilling
  - the designed algorithm contains the intelligence of its developer
- Algorithms are a fundamental part of Computer Programming and of Computing Science