Algorithms

Computational Thinking

Abstraction = the process of removing unnecessary detail from a problem.

Decomposition = breaking a larger problem into smaller manageable tasks.

Algorithmic thinking = a way of defining the steps required to reach a solution.

Searching Algorithms:

Binary Search

A binary search only works if the list is **sorted**. Split the list in two and discard the half which the value you are searching for will not be in. Repeat until the correct item is found.

Linear Search

A linear search does not require the list to be sorted. Start at one end of the list and check if the item is the one you are looking for. If it is not move onto the next item. Stop when the item has been found.

Sorting algorithms:

Bubble sort

Bubble Sort is the simplest sorting algorithm that works by repeatedly swapping the neighbouring elements if they are in wrong order.

Merge sort

There are two stages to performing a merge sort; the first divides the cards into separate components. The second stage repeatedly merges them to produce new sorted sub-arrays until there is only one large sorted array remaining.

Insertion sort

Insertion sort works by removing the first item in the array and moving into another array sorting it into position immediately before bringing in the next item.

PSEUDOCODE

Pseudocode is a generic language used to help write algorithms in the planning stages of writing computer programs. It is not a specific programming language and there are no set rules but you must be consistent and the meaning should be clear.

FLOW DIAGRAMS

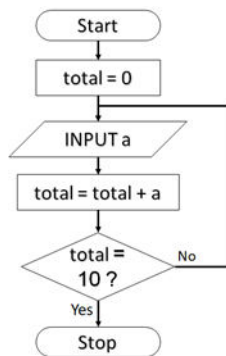Flow diagrams are a graphical representation of the routes available through an algorithm.
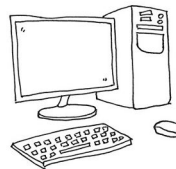
Symbol	Meaning
	Terminators used to define where the algorithm starts and stops
	Input / Output used to define the user input or the output to be shown
	Process used to define something that has to be performed by the algorithm for instance a mathematical function etc.
	Decision / Selection used to define a question and multiple arrows will define the possible outcomes
	Sub program used to show where the main program will be diverted to a sub program (shown as a separate flow chart)

Example pseudocode and flow diagram

```
total = 0
repeat
    a = input("Enter a number")
    total = total + a
UNTIL total = IO
```
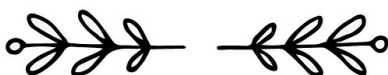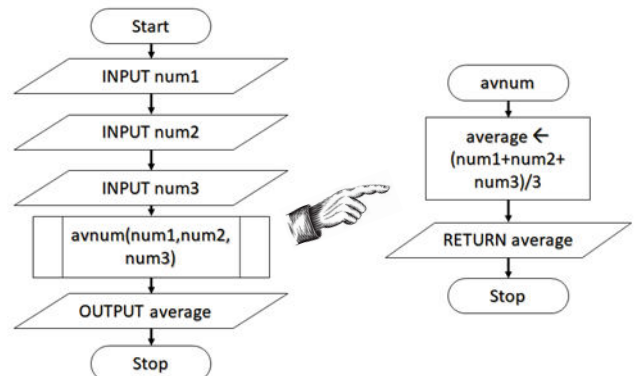
Flow diagram:

Start → total = 0 → INPUT a → total = total + a → total = 10 ? — No (loops back) / Yes → Stop

This loop asks the user to enter a number and adds it to the total. The loop stops when the total reaches 10

Sub programs

Sub programs are used to split a large program into smaller chunks or enable repetition of code.

Start → INPUT num1 → INPUT num2 → INPUT num3 → avnum(num1,num2, num3) → OUTPUT average → Stop

avnum → average ← (num1+num2+num3)/3 → RETURN average → Stop

Algorithms

Revise it 👉

Highlight

Highlight key words (maximum of 2 per sentence) and then cover the page and try to write down all the key words you can remember. Go back and fill in all the ones you have missed.

Mind map

Using the handout, draw a mind map and include as many colours, images and diagrams as you can to illustrate it

Post-it notes

Write a key word and the definition on a post-it note and stick them around your study area as a reminder of the terminology.

Record your notes

Re-write the handout in your own words and record yourself using your phone as you read your notes aloud.

Bullet Points

Write the main headings (leaving space between each) and then write bullet points of the main key points you need to remember under each heading. Re-read the handout and add any missed points to your list.

TEST YOURSELF

Cover your notes and the answer before you attempt to answer BOTH PARTS of this practice exam question.

a) Show the stages of a bubble sort to put these countries into alphabetical order *[4 marks]*
France, Germany, Switzerland, Egypt, Australia
b) Explain one advantage of using an insertion sort over a merge sort *[2 marks]*

Mark your answer

For part a give one point for each correct row shown, maximum 4 points. For part b give 1 point for identifying an advantage and 1 point for relating it specifically to insertion and merge sorts.

Part a:
- France, Germany, Egypt, Australia, Switzerland (Switzerland is moved to the end)
- France, Egypt, Australia, Germany, Switzerland (Germany moves behind Egypt and Australia but before Switzerland)
- Egypt, Australia, France, Germany, Switzerland (Egypt and Australia are moved before France)
- Australia, Egypt, France, Germany, Switzerland (Egypt and Australia are swapped around)

Part b:
- Insertion sort uses less computer memory *[1 mark]* as merge sorts use more than one list but insertion sort does all the sorting in a single list. *[1 mark]*
- Insertion sort is quicker *[1 mark]* as merge sort has a two stage process to merge the lists together. *[1 mark]*