Introduction to Computer Algorithms

Background Information

A computer algorithm can be considered to be a finite set of instructions used to solve a particular problem. A computer algorithm must be:

a) **Well Ordered** – The steps must be in a clear order.
b) **Unambiguous** – There must be no doubt as to what the steps mean
c) **Finite** – It must be possible to gain a result in a finite time.

Computer algorithms are considered to be an application of the branch of mathematics called **Discrete Mathematics**. In discrete mathematics, quantities are found by counting. Discrete mathematics can be used to solve complex problems in many areas, including:

a) What is the best route for a gritting truck to follow so that it covers every road in on its route in the minimum distance?
b) What is the minimum quantity of cable needed to link a network of computers together?
c) What is the best order to decorate a house?

Interesting Fact

The map of the London Underground is recognized across the world. It was designed by Harry Beck, an electrical draughtsman, who realised that, as the railway could not be seen, it was not necessary to put every station in its correct geographical location. He based the design on the electrical diagrams he was drawing as part of his job.

London Underground Map

Statistical Algorithm

This is a very simple algorithm used with a list of numbers:

> 1. Arrange the numbers in ascending order
> 2. Delete the numbers at either end of the list
> 3. Repeat step 2 until either one or two numbers remain
> 4. If one number remains, write it down.
>   If two numbers remain, write down the arithmetic mean of the two numbers.

Try out the algorithm, with this set of instructions: 35   14   21   45   31   12

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Can you tell what this algorithm does?

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Does it fit all the criteria for an algorithm? Is it *well ordered, unambiguous* and *well defined?* Explain.

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Zeller's Algorithm
Pseudo code is a sort of cross between English and computer code. It allows for easy transfer of the algorithm to a computer language. Zeller's Algorithm can be written in pseudo code.
Zeller's algorithm is used to find out on which day of the week you were born. Have a go at using it:

> 1. Let the day number = D
> 2. Let the month number = M
> 3. Let the year number = Y
> 4. If M is 1 or 2, add 12 to M and subtract 1 from Y.
> 5. Let A be the first two digits of Y and B be the last two digits of Y.
> 6. Add together the integer (whole number) parts of (2.6M - 5.39), (B/4) and (A/4), then add on D and B and subtract 2A.
> 7. Find the remainder when this quantity is divided by 7.
> 8. If the remainder is 0, the day was a Sunday, if it is 1, a Monday and so on.

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Algorithmic Flowchart

Flowcharts are used to represent algorithms in diagrammatic form. There are conventions for the symbols used in flowcharts.

	Oval boxes are used for starting, stopping, putting data in and printing data out.
	Rectangular boxes are used to give instructions or make calculations.
	Diamond shaped boxes are used for decisions that affect future actions.

Applications of Algorithmic Flowcharts

Here is a flow chart showing Euclid's method for finding the highest common factor (H.C.F.) of two integers, a and b.

Try out Euclid's method to calculate the HCF of the following intergers, a = 64 and b = 48.

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Start

Read a,b

Is a > b ? → Take b from a to get a new value for a

Is a < b ? → Take a from b to get a new value for b

Is a = b ?

Output a

End