

Unit 1 *Algorithmic Approach*

Introduction

Learning objectives

In this unit we give an overview of problem solving, based on an algorithmic approach. After completing this unit you should

- understand what is meant by an algorithmic approach to solving a certain class of problems;
- be able to develop algorithmic methods to solve classes of problems;
- appreciate the role that such approaches can have in effecting mathematical modelling.

Notes

An algorithm is a set of prescribed procedures that solve a particular type of problem. The method requires initial input data, well-defined iterative methods and results in output data providing a solution to the original problem. Algorithms are used for calculation, data processing and automated reasoning.

The concept of algorithms has existed for centuries but the modern, formalised algorithm began with attempts to solve the Entscheidungsproblem (the decision problem) posed by the important and respected German mathematician and logician, David Hilbert (1862 - 1943) in 1928.

Algorithms are essential to the way computers process data. Many computer programs contain algorithms that detail the specific instructions a computer should perform (in a specific order) to carry out a specified task.

Key points

An algorithm is a finite set of instructions with the following properties:

- *precision* - each step is uniquely defined
- *uniqueness* - all intermediate results are uniquely defined
- *finiteness* - the algorithm will stop after a finite number of steps
- *input* - the algorithm requires input
- *output* - the algorithm produces output
- *generality* - the algorithm can be applied to any set of inputs.

Glossary of terms

Input - the data that is put into the algorithm

Output - the data the algorithm produces.