

Unit 1—Algorithms...

HCCS STEM—Computer Science, IT, Engineering, Food/Nutrition, Business Studies

What do I need to be able to do?

Design and write algorithms using tools like flowcharts and pseudocode. Implement basic structures: sequence, selection, and iteration. Understand data types, variables, and operators.

Write and use subprograms (functions/subroutines) effectively. Pass and accept values. Know the difference between global and local variables.

Understand and evaluate algorithms, specifically searching algorithms (binary and linear). Use trace tables to follow algorithm execution. Identify different types of errors. Assess algorithm efficiency and fitness for purpose. Implement input validation.

Decomposition involves breaking down a large problem into smaller, more manageable sub-problems. This process makes the overall problem easier to solve. **Abstraction**, on the other hand, is about removing unnecessary detail from a problem so you can focus on the essential components. It means removing unimportant parts to concentrate on what is important. Both decomposition and abstraction are valuable strategies for solving problems.

A trace table is a tool used to manually follow the steps of an algorithm or program. It allows you to record the values that variables hold at different points as the algorithm is executed. This process helps in understanding how the algorithm works and determining its output for a given set of data.

Bubble sort repeatedly steps through the list, compares adjacent elements and swaps them if they are in the wrong order, making it simple but inefficient. Merge sort divides the unsorted list into n sublists, each containing one element, and then repeatedly merges sublists to produce new sorted sublists until there is only one sorted

Keywords

An **Algorithm** is a set of instructions for solving a problem or carrying out a task.

A **variable** is a location in memory used to temporarily store a value, such as a string or number.

Pseudocode is an informal written description used to plan algorithms without strict programming syntax.

A **Flowchart** is a diagram using standard symbols to show the steps and direction of flow in an algorithm.

A **Subprogram** (or function/subroutine) is a reusable block of code that can be called from elsewhere in the program to perform a specific task.

A **Trace Table** is used to determine and record the values that variables hold at different points as an algorithm runs.

An **Error** can be a problem in a program, such as a **syntax error** (grammar rule violation), a **logic error** (doesn't do what's intended), or a **runtime error** (occurs while running, e.g., divide by zero).

A **Search Algorithm** is a method for finding a specific item within a collection of data, examples include linear search and binary search.

When searching a list that is not sorted, a **linear search** can be performed, which involves examining items one after another in sequence. However, if the list you are searching is sorted, a **binary search** is available as a quicker method. Binary search works by repeatedly dividing the list in half and checking the middle item, allowing you to quickly narrow down where the item might be found. sublist remaining, offering better time complexity.

Your assessment is a single 1 hour examination with a typical range of EdExcel style Computer Science Questions from Unit 1. You will be expected to define terms, calculate algorithms and perform searches and sorts.

10 Test your understanding questions

Here are 10 multiple-choice questions summarising the whole unit:

1. What is a set of instructions for solving a problem or carrying out a task called?
a) A program b) A variable c) An algorithm d) A function
2. Which of the following is a tool used to plan algorithms using standard shapes and symbols? a) Pseudocode b) A flow chart c) A trace table d) A variable list
3. Which three basic structures are used to control the flow of a program?
a) Start, Process, End b) Input, Output, Calculation c) Sequence, Selection, Iteration d) Variable, Data Type, Operator
4. What kind of loop is used when you want to execute a block of code a specific number of times?
a) WHILE loop b) IF statement c) FOR loop d) Selection
5. What is the term for a reusable block of code that performs a specific task and can be called by its name?
a) A loop b) A variable c) An algorithm d) A subprogram (or function/subroutine)
6. A location in memory used to temporarily store a value (like a number or text) is called a:
a) Data type b) variable c) Constant d) Operator
7. Which search algorithm is most efficient when searching for an item in a list that is already sorted?
a) Linear search b) Bubble sort c) Binary search d) Merge sort
8. What tool is used to manually follow the execution of an algorithm step-by-step and record the values of variables?
a) Pseudocode b) A flowchart c) A trace table d) A program
9. An error where the program code does not conform to the rules or grammar of the programming language is known as a:
a) Logic error b) Runtime error c) Syntax error d) Semantic error
10. The strategy of breaking down a large problem into smaller, more manageable parts is called:
a) Abstraction b) Modelling c) Decomposition d) Algorithmic thinking

10 Test your understanding answers

10, 2b, 3c, 4c, 5d, 6b, 7c, 8c, 9c, 10c