Definitions and Concepts for AQA Computer Science AS-level

Topic 4: Theory of Computation

4.1 Abstraction and Automation

4.1.1 Problem Solving

Logical Reasoning: The use of a set of facts (axioms) to draw conclusions and determine whether new information is true or false.

4.1.2 Following and Writing Algorithms

Algorithms: A sequence of steps that can be followed to complete a task and that always terminates.✢

Correctness: An algorithm is said to be correct when it is consistent with the specification and produces the expected output for any given input.

Efficiency: A property of an algorithm that is related to the amount of resources (memory space and time in particular) that an algorithm uses in its execution.

Hand-tracing: The process of looking at a program's entire code or code extract and running through the instructions as though you are the computer.

Pseudo-code: A human-readable method of writing the steps of an algorithm without any particular programming language.

4.1.3 Abstraction

Abstraction by Generalisation or Categorisation: Simplifying a problem by grouping together common characteristics of a problem to arrive at a hierarchical relationship.

Representational Abstraction: Simplifying a problem by only taking into consideration the necessary details required to obtain a solution, leaving a representation without any unnecessary details.

4.1.4 Information Hiding

Information Hiding: The process of hiding all details of an object that do not contribute to its essential characteristics.✢

4.1.5 Procedural Abstraction

Procedural Abstraction: Simplifying a problem by breaking it down into a series of procedures or subroutines that are generalised with variable parameters. Knowledge of the implementation of each procedure is irrelevant.

Procedure: The result of abstracting away the actual values used in any particular computation is a computational pattern or computational method. ✢

4.1.6 Functional Abstraction

Functional Abstraction: Simplifying a problem by breaking it down into a series of reusable functions which disregard the particular computational method.

4.1.7 Data Abstraction

Data Abstraction: The storage and representation of data in a computer system along with its logical description and interaction with operators. This allows the construction of new compound data objects from existing ones.

Data Objects: Data abstractions that hide details of how data are actually represented from the user.

4.1.8 Problem Abstraction/Reduction

Problem Abstraction/Reduction: The repeated removal of unnecessary details from a problem until an underlying problem representation is reached which is identical to a previously solved problem.

4.1.9 Decomposition

Procedural Decomposition: The process of breaking down a problem into a number of sub-problems, so that each sub-problem accomplishes an identifiable task, which might itself be further subdivided. ✢

4.1.10 Composition

Composition Abstraction: The reverse process of decomposition where a complex system of compound procedures is built from its smaller, simpler procedures.

Data Abstraction Composition: The process of combining data objects to form compound data. ✢

4.1.10 Automation

Automation: The process of creating algorithms and implementing them as data structures and models of real-life situations that run without a significant need for human intervention.

4.2 Finite State Machines (FSMs)

4.2.1 Finite State Machines (FSMs) Without Output

Accepting States: An optional state of a FSM that indicates whether or not an input has been accepted by the FSM.

Finite State Machines: A model of computation for a machine that is always in one of a fixed number of states.◊

State Transition Diagrams: A visual representation of a FSM that uses circles to represent states and arrows to indicate transitions between states.

State Transition Tables: A tabular representation of a FSM that contains the current state, inputs and their consequent successor state.

Definitions with a '✢' taken from AQA AS and A-level Computer Science specification version 1.5
Definitions with a '◊' taken from AQA AS and A-level Computer Science subject specific vocabulary (last accessed 7th April 2021)