

## Computing programmes of study

### Purpose of study

A high-quality computing education equips pupils to understand and change the world through computational thinking. It develops and requires logical thinking and precision. It combines creativity with rigour: pupils apply underlying principles to understand real-world systems, and to create purposeful and usable artefacts. More broadly, it provides a lens through which to understand both natural and artificial systems, and has substantial links with the teaching of mathematics, science, and design and technology.

At the core of computing is the science and engineering discipline of computer science, in which pupils are taught how digital systems work, how they are designed and programmed, and the fundamental principles of information and computation. Building on this core, computing equips pupils to apply information technology to create products and solutions. A computing education also ensures that pupils become digitally literate to use, and express themselves through, information and communication technology a level suitable for the future workplace and as active participants in a digital world.

### Aims

The National Curriculum for computing aims to ensure that all pupils:

- can understand and apply the fundamental principles of computer science including logic, algorithms, data representation, and communication
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
- can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems and be responsible, competent, confident and creative users of information and
- communication technology.

### Attainment targets

By the end of each key stage, pupils are expected to know, apply and understand the matters, skills and processes specified in the relevant programme of study.

## Subject content

### Key Stage 1

Pupils should be taught to: understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following a sequence of instructions write and test simple programs use logical reasoning to predict the behaviour of simple programs organise, store, manipulate and retrieve data in a range of digital formats communicate safely and respectfully online, keeping personal information private, and recognise common uses of information technology beyond school.

### Key Stage 2

Pupils should be taught to: design and write programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts use sequence, selection, and repetition in programs; work with variables and various forms of input and output; generate appropriate inputs and predicted outputs to test programs use logical reasoning to explain how a simple algorithm works and to detect and correct errors in algorithms and programs understand computer networks including the internet; how they can provide multiple services, such as the world-wide web; and the opportunities they offer for communication and collaboration describe how internet search engines find and store data; use search engines effectively; be discerning in evaluating digital content; respect individuals and intellectual property; use technology responsibly, securely and safely select, use and combine a variety of software (including internet services) on a range of digital devices to accomplish given goals, including collecting, analysing, evaluating and presenting data and information.

### Key Stage 3

Pupils should be taught to:

- design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems
- understand at least two key algorithms for each of sorting and searching; use logical reasoning to evaluate the performance trade-offs of using alternative algorithms to solve the same problem
- use two or more programming languages, one of which is textual, each used to solve a variety of computational problems; use data structures such as tables or arrays; use procedures to write modular programs; for each procedure, be able to explain how it works and how to test it
- understand simple Boolean logic (such as AND, OR and NOT) and its use in determining which parts of a program are executed; use Boolean logic and wild-cards in search or database queries; appreciate how search engine results are selected and ranked
- understand the hardware and software components that make up networked computer systems, how they interact, and how they affect cost and performance; explain how networks such as the internet work; understand how computers can monitor and control physical systems
- explain how instructions are stored and executed within a computer system
- explain how data of various types can be represented and manipulated in the form of binary digits including numbers, text, sounds and pictures, and be able to carry out some such manipulations by hand
- undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users create, reuse, revise and repurpose digital information and content with attention to design, intellectual property and audience.

### Key Stage 4

All pupils must have the opportunity to study aspects of information technology and computer science at sufficient depth to allow them to progress to higher levels of study or to a professional career.

All pupils should be taught to:

- develop their capability, creativity and knowledge in computer science, digital media and information technology
- develop and apply their analytic, problem-solving, design, and computational thinking skills.

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