Computer systems

Systems architecture

- the purpose of the CPU
- Von Neumann architecture
- common CPU components and their function
- the function of the CPU as fetch and execute instructions stored in memory
- embedded systems - purpose and examples of embedded systems.

Memory

- the difference between RAM and ROM
- the need for virtual memory
- flash memory

Storage

- the need for secondary storage
- data capacity and calculation of data capacity requirements
- common types of storage
- suitable storage devices and storage media, and the advantages and disadvantages of these, using characteristics

Wired and wireless networks

- types of networks - LAN (Local Area Network) WAN (Wide Area Network)
- factors that affect the performance of networks
- the different roles of computers in a client-server and a peer-to-peer network
- the concept of virtual networks

Network topologies, protocols and layers

- star and mesh network topologies
- Wifi / ethernet
- the uses of IP addressing, MAC addressing, and protocols
- the concept of layers
- packet switching

System security

- forms of attack
- identifying and preventing vulnerabilities

Systems software

- the purpose and functionality of systems software
- operating systems
- utility system software

Ethical, legal, cultural and environmental concerns

- how to investigate and discuss Computer Science technologies
- how key stakeholders are affected by technologies
- environmental impact of Computer Science
- cultural implications of Computer Science
- legislation relevant to Computer Science:
    - The Data Protection Act 1998
    - Computer Misuse Act 1990
    - Copyright Designs and Patents Act 1988
    - Creative Commons Licensing
    - Freedom of Information Act 2000

Computational Thinking

Algorithms

- computational thinking:
  - abstraction
  - decomposition
  - algorithmic thinking
- standard searching algorithms:
  - binary search
  - linear search
- standard sorting algorithms:
  - bubble sort
  - merge sort
  - insertion sort
- how to produce algorithms using:
  - pseudocode
  - using flow diagrams
- interpret, correct or complete algorithms

Computational logic

- why data is represented in computer systems in binary form
- simple logic diagrams using the operations AND, OR and NOT and their truth tables
- combining Boolean operators using AND, OR and NOT to two levels
- applying logical operators in appropriate truth tables to solve problems
- applying computing-related mathematics: + - / * Exponentiation ^ MOD DIV

Translators and facilities of languages

- characteristics and purpose of different levels of programming language, including low level languages
- the purpose of translators
- the characteristics of an assembler, a compiler and an interpreter
- common tools and facilities available in an integrated development environment (IDE):
  - editors
  - error diagnostics
  - run-time environment
  - translators

Data representation

Units

- bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte, petabyte
- how data needs to be converted into a binary format to be processed by a computer.

Numbers

- how to convert positive denary whole numbers (0–255) to 8 bit binary numbers & vice versa
- binary shifts
- how to convert positive denary whole numbers (0–255) to 2 digit hexadecimal numbers & vice versa
- how to convert from binary to hexadecimal equivalents and vice versa
- check digits.

Characters

- the use of binary codes to represent characters
- the term ‘character-set’
- the relationship between the number of bits per character in a character set and the number of characters which can be represented (for example ASCII, extended ASCII and Unicode)

Images

- how an image is represented as a series of pixels represented in binary
- metadata included in the file
- the effect of colour depth and resolution on the size of an image file

Sound

- how sound can be sampled and stored in digital form
- how sampling intervals and other factors affect the size of a sound file and the quality of its playback

Compression

- need for compression & types of compression - lossy lossless