The English Martyrs Catholic School and Sixth Form College

Year 11 Knowledge organiser

Computer Science

A Member Of
**Bishop
Hogarth**
Catholic Education Trust

Name:

Computer Science

Topic 1.1 – System Architecture

1.1.1 Architecture of the CPU
- Purpose of the CPU
- Common CPU components and their function
- Von Neumann Architecture

1.1.2 CPU Performance
- Clock Speed
- Cache Size
- Number of Cores

1.1.3 Embedded Systems
- Purpose of the CPU
- Common CPU components and their function
- Von Neumann Architecture

Topic 1.2 – Memory and Storage

1.2.1 Primary Storage (Memory)
- Need for primary storage
- Difference between RAM and ROM
- Purpose of ROM and RAM in computer systems
- Virtual Memory

1.2.2 Secondary Storage
- Need for secondary storage
- Types of storage; optical, magnetic, solid state
- Suitable storage devices for a given application
- Advantages and disadvantages of storage devices
  - Capacity, Speed, Portability, Durability, Reliability, Cost

1.2.3 Units
- Units of data storage
- Converting into a binary format
- Data capacity and calculations of data capacity requirements

1.2.4 Data Storage
- Numbers, Characters, Images, Sound

1.2.5 Compression
- The need for compression.
- Types of compression; Lossy and Lossless

Topic 1.3 – Networks and Protocols

1.3.1 Networks and Topologies
- Types of Network; LAN, WAN and factors that affect performance
- Client-server and peer-to-peer networks
- Hardware required; WAP, router, switch, NIC, transmission media
- Worldwide collection of networks; DNS, hosting, cloud, servers
- Star and mesh network topologies

1.3.2 Wired & Wireless Networks, Protocols & Layers
- Mode of connection; wired, wireless
- Encryption
- IP and MAC Addressing
- Standards
- Common protocols; TCP/IP, HTTP, HTTPS, FTP, POP, IMAP, SMTP

Topic 1.4 – Network Security

1.4.1 Threats to Computer Systems and Networks
- Forms of attack; Malware, social engineering, brute-force attacks, denial of service attacks, data interception and theft, SQL injection

1.4.2 Identifying and Preventing Vulnerabilities
- Prevention; Penetration testing, anti-malware software, firewalls, user access levels, passwords, encryption, physical Security

Topic 1.5 – Systems Software

1.5.1 Operating Systems
- User interface, memory management and multitasking, peripheral management and drivers, user management, file management

1.5.2 Utility Software
- Encryption, defragmentation, data compression

Topic 1.6 – Ethical, Legal, Cultural

1.6.1 Ethical, legal, cultural & environmental impact
- Ethical, legal, cultural, environmental, privacy issues.
- Data Protection, computer misuse, Copyright, design and patents

KEYWORDS

Cache – Super fast memory next to the CPU for storing commonly used data and instructions.

Accumulator – Register used by the ALU to store calculation results.

Virtual Memory – A section of secondary storage temporarily used as RAM.

Client Server – Relationship in which data or web applications are hosted on the server and accessed by client computers.

Peer to Peer – Relationship where all computers share responsibility and there is no central server.

IP Address – Unique address for each device on a network.

Layering – In networking, concept of breaking up communication into separate components or activities.

SQL Injection – Ensuring that all data input is sanitized by forcing data into the format you want such as data, text, integer etc.

Driver – Software that controls and communicates with peripherals.

Computer Science

Topic 1.2 – Algorithms

2.1.1 Computational Thinking
- Abstraction
- Decomposition
- Algorithmic Thinking

2.1.2 Designing, Creating & Refining Algorithms
- Identifying inputs, processes, and outputs for a problem
- Structure diagrams
- Pseudocode, Flowcharts, Reference Language
- Trace Tables

2.1.3 Searching & Sorting Algorithms
- Standard searching; binary search, linear search
- Standard sorting; Bubble sort, Merge sort, Insertion sort

Topic 2.2 – Programming Fundamentals

2.2.1 Programming Fundamentals
- Variables, constants, operators, inputs, outputs, assignments
- Controlling program flow;
    - Sequence, selection, iteration
- Common arithmetic operators
- Common Boolean operators
    - AND, OR, NOT

2.2.2 Data Types
- Use of data types.
    - Integer, real, Boolean, character, string, casting

2.2.3 Additional Programming Techniques
- Use of basic string manipulation
- Basic file handing operators; open, read, write, close
- Use of records to store data
- Use of SQL to search for data
- Use of arrays when solving problems; 1D and 2D
- How to use sub-programs to produce structured code
- Random number generation

Topic 2.3 – Producing Robust Programs

2.3.1 Defensive Design
- Defensive design considerations; anticipating misuse, authentication
- Input validation
- Maintainability;
    - Sub programs, conventions, indention, commenting

2.3.2 Testing
- The purpose of testing
- Types of testing; Iterative, final/terminal
- Identify syntax and logic errors
- Selecting suitable test data; normal, boundary, invalid/erroneous
- Refining algorithms

Topic 2.4 – Boolean Logic

2.4.1 Boolean Logic
- Simple logic diagrams using the operators AND, OR and NOT
- Truth tables
- Combining Boolean operators using AND, OR and NOT
- Applying logical operators in truth tables to solve problems

Topic 2.5 – Programming Languages

2.5.1 Languages
- Characteristics and purpose of different levels of programming language;
    - High-Level Languages
    - Low-Level Languages
- The purpose of translators
- Characteristics of a compiler and an interpreter

2.5.2 Integrated Development Environment
- Common tools and facilities available in an IDE
- Editors
- Error diagnostics
- Run-time environment
- Translators

KEYWORDS

Abstraction - Process of extracting or withdrawing something.

Decomposition - Breaking down complex problems into smaller parts that are manageable.

Pseudocode - Method of writing up a set of instructions using plain English, used in planning.

Assignment - Setting the value of a variable in a computer program.

Pseudocode - Method of writing up a set of instructions using plain English, used in planning.

Integer - A whole number.

Real - Decimal number, called a float in Python.

String - A sequence of characters which includes letters, numbers and symbols.

Casting - Changing the data type of a variable.

Syntax Error - Error in a program resulting from not following the rules of the language.