

Year 9 – Computer Science:

Throughout the year practical programming lessons on Python will take place, in addition to the theory below.

Theory

1. The Central Processing Unit

- Components of the CPU
- CPU Performance
- Embedded Systems



2. Primary and Secondary Storage

- Primary Storage Devices
- Virtual Storage
- Secondary Storage Devices



3. Data Representation

- Binary Conversions
- Hexadecimal Conversions
- Image Representation
- Sound Representation
- Compressing Data



Assessment Window 1

Assessment to cover the Central Processing Unit, Primary & Secondary Storage and Data Representation

Assessment Window 2

Assessment to cover Networks, Protocols & Layers and Threats to Computer Systems and Networks



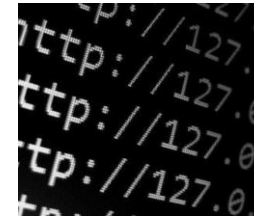
6. Threats to Computer Systems and Networks

- Describe the different strategies criminals use to attack networks
- Explain how to identify these threats
- Explain how to protect against threats



5. Protocols and Layers

- Explain how data is transmitted across the internet
- Describe the purposes and functions of protocols
- Explain how layers are used in protocols



4. Networks

- Types of Networks
- How Computers Connect to Networks
- The Internet and The Cloud
- Network Topologies
- Factors that Affect Network Performance



7. Operating Systems and Utility Software

- Systems Software and Applications
- Types of Management
- Utility and Encryption Software
- Defragmentation



8. Ethical, Legal, Cultural and Environmental Impact of Digital Technology

- Discuss the ethical, legal, cultural and environmental issues in relation to their impact on digital technology
- Discuss legislation relevant to digital technology eg. The Data Protection Act 2018



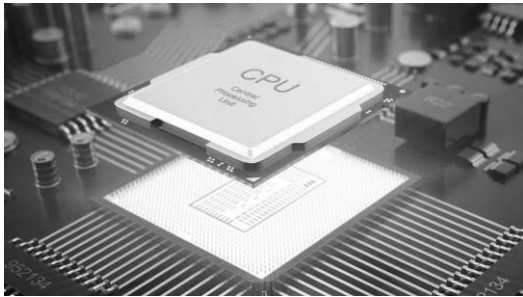
Assessment Window 3

End of Year Exam covering all of the topics learnt throughout the year.

CAREERS: At every available opportunity, teachers will introduce and promote careers links to the topics being studied (See Careers booklets)

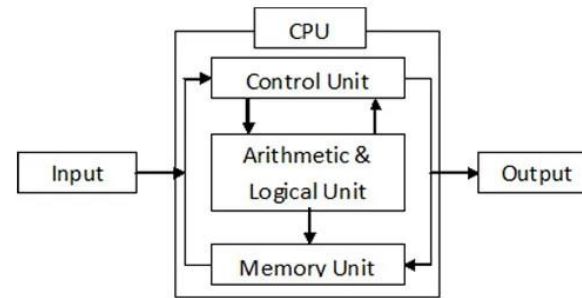
Year 9 – Computer Science: Theory

1. The Central Processing Unit



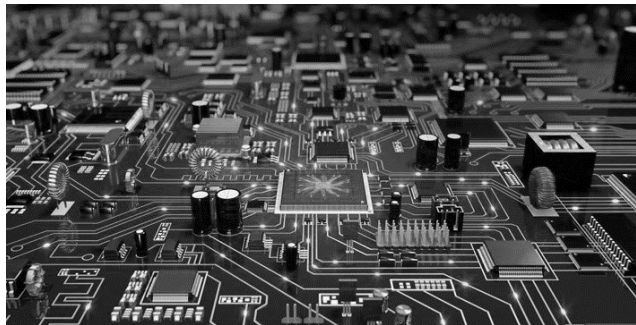
1. Introduction to the CPU

- What is the CPU?
- What is its function within the computer?
- The Fetch-Execute Cycle



2. Components of the CPU

- ALU
- CU
- Buses
- Registers



4. Embedded Systems

- What is an embedded system?
- Examples of embedded systems

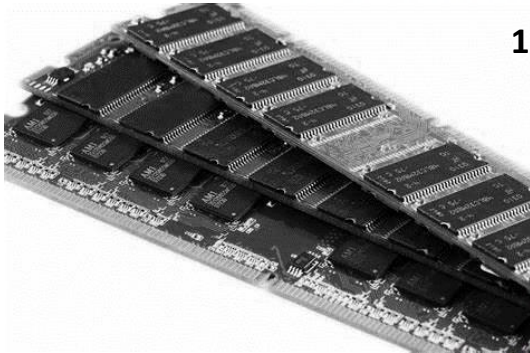


3. Factors that Affect CPU Performance

- Clock Speed
- Cache
- Number of Cores

Year 9 – Computer Science: Theory

2. Primary and Secondary Storage



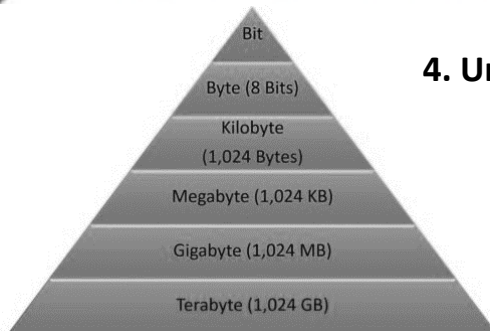
1. Primary Storage

- What is primary storage?
- RAM
- ROM
- Volatility
- Virtual Memory



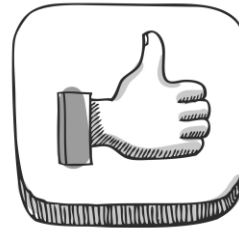
2. Secondary Storage

- Optical Storage
- Solid State Storage
- Magnetic Storage



4. Units

- What units do we use to measure data on the computer?
- Converting between units of measurement



3. Evaluating Storage Methods

- Advantages and Disadvantages of Secondary Storage Methods

Year 9 – Computer Science: Theory

3. Data Representation

1. Binary Conversion

- Converting between denary and binary
- Binary addition
- Binary shift

| Decimal | Binary | Hexadecimal |
|---------|--------|-------------|
| 0 | 0000 | 0 |
| 1 | 0001 | 1 |
| 2 | 0010 | 2 |
| 3 | 0011 | 3 |
| 4 | 0100 | 4 |
| 5 | 0101 | 5 |
| 6 | 0110 | 6 |
| 7 | 0111 | 7 |
| 8 | 1000 | 8 |
| 9 | 1001 | 9 |
| 10 | 1010 | A |
| 11 | 1011 | B |

2. Hexadecimal Conversions

- Converting between binary and hexadecimal
- Converting between denary and hexadecimal

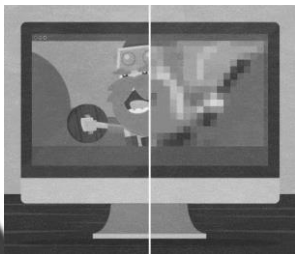
3. Character Sets

- ASCII Code
- Extended ASCII
- Unicode

| Dec | Bin | Char |
|-----|-----------|------|
| 96 | 0110 0000 | ` |
| 97 | 0110 0001 | a |
| 98 | 0110 0010 | b |
| 99 | 0110 0011 | c |
| 100 | 0110 0100 | d |
| 101 | 0110 0101 | e |
| 102 | 0110 0110 | f |
| 103 | 0110 0111 | g |
| 104 | 0110 1000 | h |

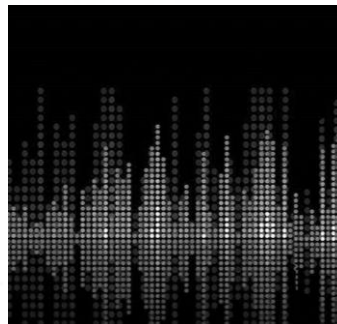
6. Compression

- Lossless
- Lossy



5. How we Represent Sound

- Analogue vs Digital
- Sample Rate
- Bit Depth
- Audio File Size



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

4. How we Represent Images

- Pixels
- Bitmaps
- Colour Depth
- Image File Size
- Metadata

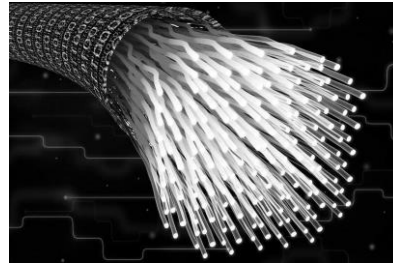
Year 9 – Computer Science: Theory

4. Networks



1. Types of Networks

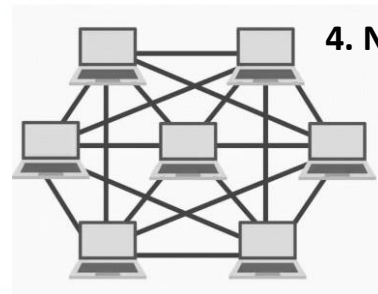
- LAN
- WAN
- Peer to Peer
- Client Server



2. How do computers connect to a network?

- Connection Hardware
 - NIC
 - Router
 - Switch
 - Wireless Access Points
- Transmission Media

5. Factors that affect performance of networks



4. Network Topologies

- Star Topology
- Mesh Topology

3. The Internet and The Cloud



- How do we connect?
- Hosts
- IP Addresses
- DNS
- Advantages and Disadvantages of the Cloud

Year 9 – Computer Science: Theory

5. Protocols and Layers

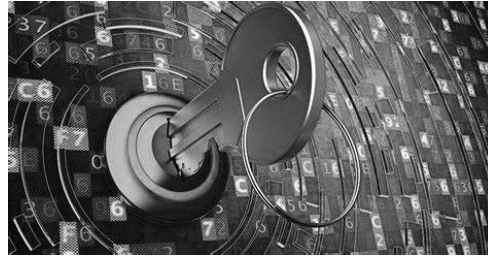


1. What is a Protocol?

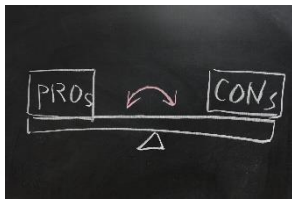
- Differences between WiFi and Bluetooth

2. Encryption

- Why we use encryption

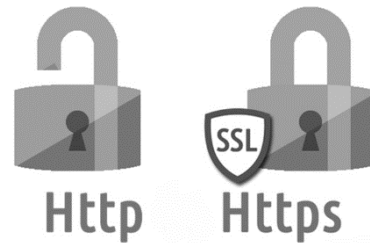


5. Benefits of layering networks



4. Protocols and Network Layers

- Four Layers
- Protocols of the Application Layer



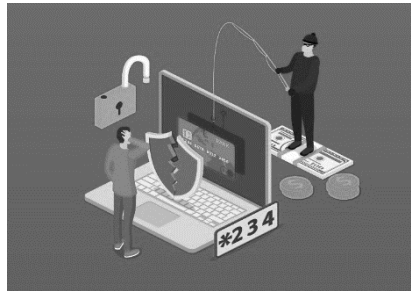
3. Packets

- What is a packet?
- Packet Switching



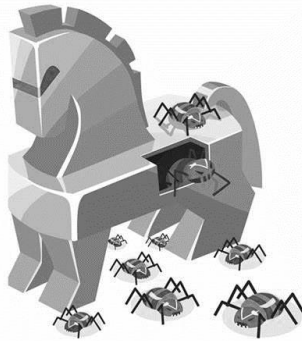
Year 9 – Computer Science: Theory

6. Threats to Computer Systems and Networks



1. Social Engineering Methods of Attack

- Shouldering
- Blagging
- Phishing



2. Different Types of Malware

- Virus
- Worm
- Trojan Horse
- Spyware
- Adware



4. Identifying and Preventing Vulnerabilities

- Penetration Testing
- User Access Levels
- Firewalls
- Anti-Malware Software



3. Methods of Attack

- Brute Force Attack
- Denial of Service
- Data Interception and Theft
- SQL Injection

Year 9 – Computer Science: Theory

7. Operating Systems and Utility Software



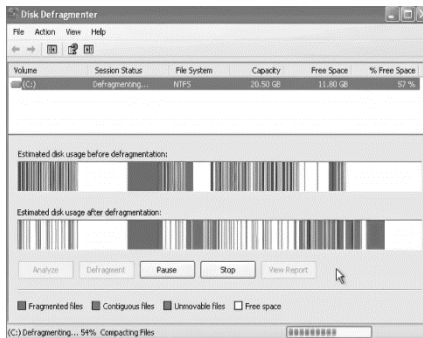
1. What is an Operating System?

- Why does our computer need an operating system?
- What does it do?
- Examples of Operating Systems



2. What does our Operating System work with?

- User Interface
- Memory Management and Multitasking
- Peripheral Management
- User Management
- File Management



4. Defragmentation and Compression

- What is defragmentation?
- How does the process of defragmentation work?



3. Utility Software

- What is utility software?
- What different types of programs would be part of utility software?

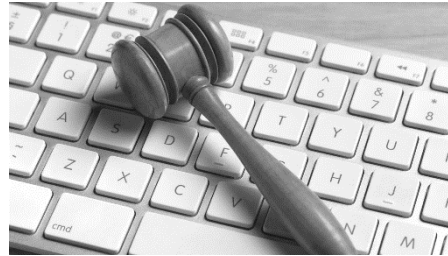
Year 9 – Computer Science: Theory

8. Ethical, Legal, Cultural and Environmental Impacts of Digital Technology



1. Ethical Issues

- Driverless Cars
- Drones
- Social Consequences



2. Legal Issues

- What legal issues could arise from the collection, storage and use of people's data?
- Rights and Permissions

5. Legislation



- Data Protection Act 2018
- The Computer Misuse Act 1990
- Copyright Designs and Patents Act
- Software Licences

4. Environmental Issues



- Energy Consumption
- E-Waste
- Monitoring Climate Change
- Conservation
- Energy Production

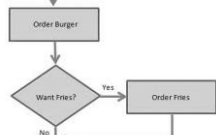
3. Cultural Issues

- Third world vs first world countries
- Developed vs Developing
- Digital Divide
- Religion

Year 10 – Computer Science:

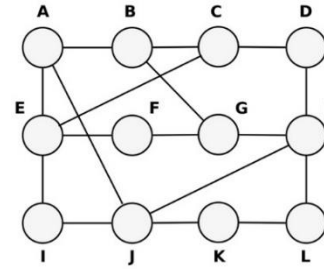
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Theory



1. Algorithms

- Computational Thinking
- Designing Algorithms
- Flowcharts
- Pseudocode



2. Searching and Sorting Algorithms

- Bubble Sort
- Insertion Sort
- Merge Sort
- Linear Search
- Binary Search



Assessment Window 1

Assessment to cover Ethical, Legal, Cultural and Environmental Impact of Digital Technology and Algorithms

Assessment Window 2

Assessment to cover Searching and Sorting Algorithms and Creating Robust Programs



| YES | | NOT | |
|-------|--------|-------|--------|
| INPUT | OUTPUT | INPUT | OUTPUT |
| A | 0 | A | 1 |
| B | 0 | B | 1 |
| 1 | 1 | 1 | 0 |

| AND | | OR | | XOR | |
|-------|--------|-------|--------|-------|--------|
| INPUT | OUTPUT | INPUT | OUTPUT | INPUT | OUTPUT |
| A | B | A | B | A | B |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 |

| NAND | | NOR | | XNOR | |
|-------|--------|-------|--------|-------|--------|
| INPUT | OUTPUT | INPUT | OUTPUT | INPUT | OUTPUT |
| A | B | A | B | A | B |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 |

4. Boolean Logic

- What is Boolean Logic?
- Truth Tables
- Logic gates
- Logic Circuits

```

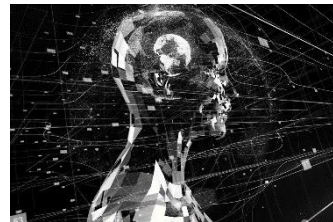
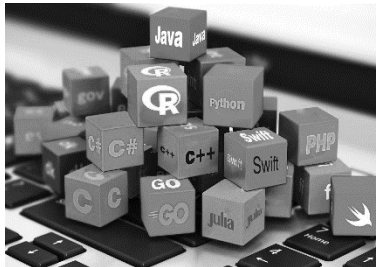
17 string sInput;
18 int iLength, iN;
19 double dblTemp;
20 bool again = true;
21
22 while (again) {
23     iN = -1;
24     again = false;
25     getline(cin, sInput);
26     system("cls");
27     stringstream(sInput) >> dblTemp;
28     iLength = sInput.length();
29     if (iLength < 4) {
30         again = true;
31         continue;
32     } else if (sInput[iLength - 3] != '.') {
33         again = true;
34         continue;
35     } while (++iN < iLength) {
36         if (!isdigit(sInput[iN])) {
37             continue;
38         } else if (iN == (iLength - 2)) {
39             continue;
40         }
41     }
42 }
  
```

3. Creating Robust Programs

- Robust programs
- Defensive design
- Anticipating misuse
- Authentication
- Maintainability
- Syntax and Logic Errors

5. Programming Languages and Integrated Development Environments

- Popular programming languages
- Machine code
- Assembly language
- Translation
- Error Diagnostics
- Run-Time Environment



6. Ethical, Legal, Cultural and Environmental Impact of Digital Technology

Continued from Year 9...

- Discuss the ethical, legal, cultural and environmental issues in relation to their impact on digital technology
- Discuss legislation relevant to digital technology eg. The Data Protection Act 2018



Assessment Window 3

End of Year Exam covering all of the topics learnt throughout the year.

CAREERS: At every available opportunity, teachers will introduce and promote careers links to the topics being studied (See Careers booklets)

Year 10 – Computer Science: Theory

1. Algorithms



1. Computational Thinking

- Decomposition
- Abstraction



2. Designing Algorithms

- Designing and creating algorithms
- What makes a successful algorithm?
- Algorithms for computers

4. Pseudocode

- Expressing algorithms as pseudocode

Pseudocode

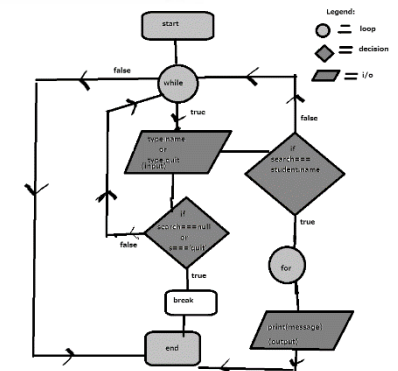
```
if the score is 90 or above
    grade is an "A"
else
    if the score is 80 or above
        grade is a "B"
    else
        if the score is 70 or above
            grade is a "C"
        else
            grade is an "F"
```

Actual Python code

```
if score >= 90:
    grade = "A"
else:
    if score >= 80:
        grade = "B"
    else:
        if score >= 70:
            grade = "C"
        else:
            grade = "F"
```

3. Flowcharts

- Flowchart symbols
- Displaying an algorithm as a flowchart



Year 10 – Computer Science: Theory

2. Searching and Sorting Algorithms



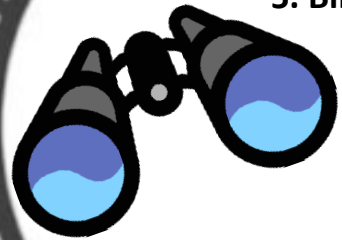
1. Bubble Sort

- Be able to use and solve problems using bubble sort algorithms
- Coding bubble sort algorithms



2. Insertion Sort

- Be able to use and solve problems using insertion sort algorithms

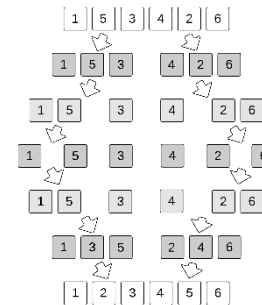


5. Binary Search

- Be able to use and solve problems using binary search
- Evaluate linear search vs binary search

4. Linear Search

- Be able to use and solve problems using linear search



3. Merge Sort

- Be able to use and solve problems using merge sort algorithms
- Be able to produce tables to show the swaps needed

Year 10 – Computer Science: Theory

3. Creating Robust Programs

1. Why Robust Programs?

- Defensive Design
- Anticipating Misuse



2. Authentication

- Input Validation
- Presence Check
- Range Check
- Length Check



4. Refining Algorithms

- Be able to refine algorithms in order improve the maintenance of programs

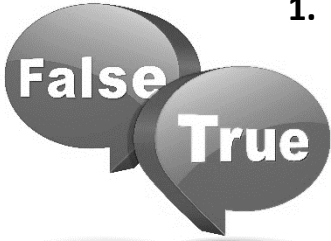


3. Maintainability and Testing

- What makes programs maintainable?
- Different types of tests
- Syntax and logic errors

Year 10 – Computer Science: Theory

4. Boolean Logic



1. What is Boolean Logic?

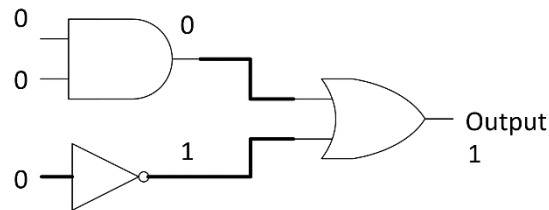
- Why Boolean Logic?
- Compound Statements

AND gate

| Input A | Input B | Output |
|---------|---------|--------|
| 0 | 0 | 0 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 1 | 1 |

2. Truth Tables

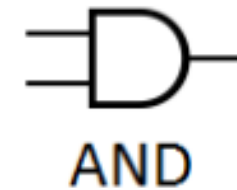
- To be able to complete truth tables for a wide range of real life examples



4. Logic Circuits

- Be able to combine logic gates to create a logic circuit

3. Logic Gates



- To be able to draw logic gates and link these to truth tables, including...
 - AND gate
 - OR gate
 - NOT gate

Year 10 – Computer Science: Theory

5. Programming Languages and Integrated Development Environments



1. Why Programming Languages?

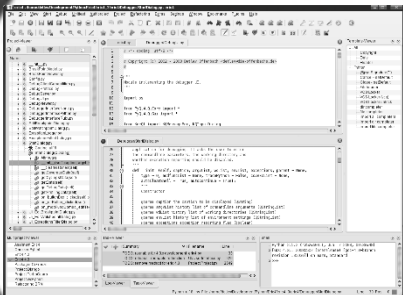
- Popular Programming Languages

Machine Code

```
10011101000110100000  
01100011010001110110  
10000010111101101110  
11110110001011011000  
10000010011100011011  
10010011000111000000
```

2. Low Level Languages

- Machine Code
- Assembly Language
- Translation
- Advantages



4. IDE's

- Source Code Editor
- Error Diagnostics
- Run-Time Environment

High Level Language

FORTRAN C PASCAL

High Level Language

Assembly Language

Machine Language

Hardware

Low Level Language

3. High Level Languages

- Compiler
- Interpreter
- Advantages

Year 10 – Computer Science: Theory

6. Ethical, Legal, Cultural and Environmental Impacts of Digital Technology



1. Ethical Issues

- Driverless Cars
- Drones
- Social Consequences



2. Legal Issues

- What legal issues could arise from the collection, storage and use of people's data?
- Rights and Permissions

5. Legislation



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- Software Licences

4. Environmental Issues



- Energy Consumption
- E-Waste
- Monitoring Climate Change
- Conservation
- Energy Production

3. Cultural Issues

- Third world vs first world countries
- Developed vs Developing
- Digital Divide
- Religion

Year 11 – Computer Science:

Throughout the year practical programming lessons on Python will take place, in addition to the theory below.

Theory of Key Topics Covered in Years 9 &10



1. The Central Processing Unit

- Components of the CPU
- CPU Performance
- Embedded Systems



2. Primary and Secondary Storage

- Primary Storage Devices
- Virtual Storage
- Secondary Storage Devices

3. Data Representation

- Binary Conversions
- Hexadecimal Conversions
- Image Representation
- Sound Representation
- Compressing Data

4. Networks

- Types of Networks
- How Computers Connect to Networks
- The Internet and The Cloud
- Network Topologies
- Factors that Affect Network Performance



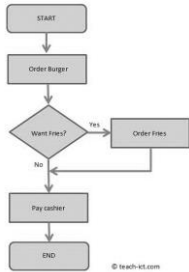
Assessment Window 1

Mock Exam



Assessment Window 2

Mock Exam



8. Algorithms

- Computational Thinking
- Designing Algorithms
- Flowcharts
- Pseudocode



7. Operating Systems and Utility Software

- Systems Software and Applications
- Types of Management
- Utility and Encryption Software
- Defragmentation

6. Threats to Computer Systems and Networks

- Describe the different strategies criminals use to attack networks
- Explain how to identify these threats
- Explain how to protect against threats



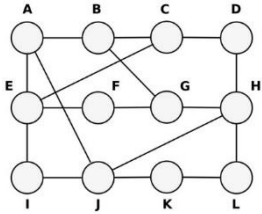
5. Protocols and Layers

- Explain how data is transmitted across the internet
- Describe the purposes and functions of protocols
- Explain how layers are used in protocols



9. Searching and Sorting Algorithms

- Bubble Sort
- Insertion Sort
- Merge Sort
- Linear Search
- Binary Search



10. Creating Robust Programs

- Robust programs
- Defensive design
- Anticipating misuse
- Authentication
- Maintainability
- Syntax and Logic Errors

11. Boolean Logic

- What is Boolean Logic?
- Truth Tables
- Logic gates
- Logic Circuits

| AND | | OR | | XOR | |
|---------|---------|---------|---------|---------|---------|
| INPUT A | INPUT B | INPUT A | INPUT B | INPUT A | INPUT B |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 |

12. Programming Languages and Integrated Development Environments

- Popular programming languages
- Machine code
- Assembly language
- Translation
- Error Diagnostics
- Run-Time Environment



13. Ethical, Legal, Cultural and Environmental Impact of Digital Technology Continued from Year 9...

- Discuss the ethical, legal, cultural and environmental issues in relation to their impact on digital technology
- Discuss legislation relevant to digital technology

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