YEAR 8
COMPUTER SCIENCE

KNOWLEDGE ORGANISER

The computer science department are introducing a new learning initiative in which all students in Key Stage 3 will be provided with knowledge organisers. We believe these will have a positive impact on your child's achievement and approach to revision, providing them with the best opportunity to be successful during assessments and examinations.

We have created a bank of resources, known as knowledge organisers, to be used both at home and in lesson. National research demonstrates knowledge organisers have a significant impact on the progress made by all students, no matter what their ability is. As a parent/carer it will also provide you with the opportunity to support your child at home.

How you the parent/carer can help:

- Print off and pin up knowledge organisers along with your child's timetable
- Encourage and reward your child when doing homework and revision
- Use the knowledge organisers to test and quiz your child on the current topic

HALF TERM 1

COMPUTING SYSTEMS

Modern computer systems receive an input, process that data and then produce an output. The data can be sored in memory. They are designed to automate any process by a program. To execute programs that operate on data.

Computing systems need a **processor**, **memory**, and **storage**. Modern systems also rely heavily on **communication** between them.

Communication Computing systems exchange information and form networks
Programs and **data** are transferred between computing systems, when required.

"AI has by now succeeded in doing essentially everything that requires 'thinking' but has failed to do most of what people and animals do 'without thinking' – that, somehow, is much harder!"
Donald Knuth, author of *The Art of Computer Programming, in **1981***
Programming computers to learn from experience

The processor (CPU)the component that **executes** program instructions.

An instruction may:

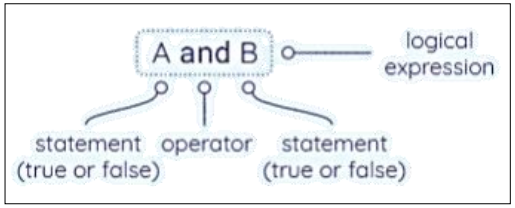
- Perform arithmetic or logic operations on data
- Perform input/output of data
- Control program flow

The **storage** (secondary memory) is the set of components that **stores** programs and data.
Storage is **persistent**: it retains its contents when the power is off.

Main memory is referred to as RAM.
The main component that **stores** the programs and data **currently in use**.

Memory is **volatile**: its contents are lost when the power is off.

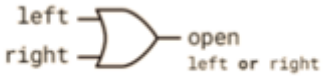
Logical operations operate on statements that are **true** or **false**. There are three basic logical operations. AND OR NOT



Logical expressions — **logic circuits** can be represented using diagrams

Logical operations — logic gates can be represented using symbols

FREE or OPEN software is where creators of a program can choose to provide access to its **source code**. This means that anyone can 'see inside' the program to understand how it works, check for errors, suggest improvements, and 'remix' it. Whilst still acknowledging the source.



HALF TERM 2

DEVELOPING FOR THE WEB

A **network** is where devices are connected together usually by cable or WiFi. This could be a few computers in a room, many computers in a building or lots of computers across the world.

Wired and **Wireless** data transmission

A computer network can be either wired or wireless.
- Wired networks send data along cables.
- Wireless networks send data through the air using radio waves.

Wired Networks
Advantages
· Faster connection (little or no interference)
· Higher bandwidth
· Better security
Disadvantages
· Cables can be a trip hazard and look messy
· More expensive and time consuming to add devices
Devices are in a fixed position, not portable

Wireless Networks
Advantages
- No trailing wires/no trip hazards
- Quick and easy to connect devices
- Allows portability

Disadvantages
- Lower bandwidth
- Wireless connections can be weakened by walls, ceilings etc
- Less secure

Key Words	
bandwidth	Amount of data that can be moved from one point to another in a given time.
buffering	Data arriving slower that it is being processed
internet	A worldwide network of computers
Internet of Things (IoT)	Takes everyday 'things' and connects them to the Internet eg smart light bulb, fridge, heating etc
IP address	A unique address for every device on the internet
packet	Networks send/receive messages in units called packets
protocol	All methods of communication need rules in place in order to pass on the message successfully. These sets of rules are called 'protocols'
Search engine	A website that allows user to look up information on WWW e.g. Bing, Google etc
Web browser	Piece of software(code) used to view information on the Internet
WWW	Part of the Internet that contains websites and webpages. NOT the same as the Internet.

'URL' stands for 'Uniform Resource Locator'.
I
t is the address of a World Wide Web page and is sometimes called the 'web address'. For example, the URL for the home page of Google is www.google.co.uk.
The "www" part tells us that it is a website.

The "google" part is known as the **domain name**. No two websites can have the same domain name.

HALF TERM 3

INTRODUCTION TO PYTHON

Python is a **text** based **programming language**. That can be used to create programs, games, applications and much more!

A **program** is a set of precise instructions, expressed in a **programming language**.
Translating the programming language is necessary for a machine to be able to **execute** the instructions.

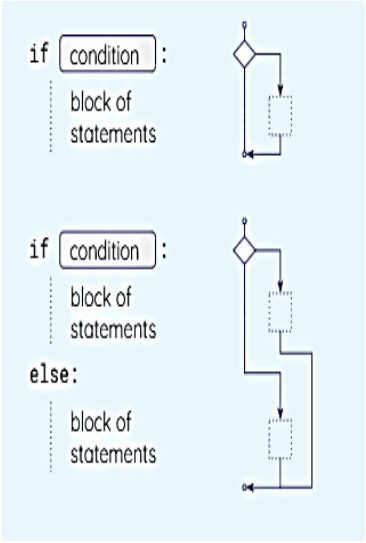
To execute a Python program, you need a **Python interpreter**.

This is a program that translates and executes your Python program.

Syntax Errors
All programming languages have rules for **syntax**, i.e. how statements can be assembled.
Programs written in a programming language must follow its syntax.
Programs with **syntax errors** cannot be translated and executed.

You can use multiple branches using if, elif and else

Python helps by telling the programmer where the error is. So if you see red error text—read it first.



Useful snippets of code	
print ("Year 8")	Will display the string "Year 8"
input ()	Reads a line of text from the keyboard and returns it
variable name = expression	Allows an expression to be assigned to a variable. E.g. year=1944
Name=[item1, item2, item3]	Allows ctreation of a list e.g. shopping = ["oranges", "apples", pears"]

Data types
Whole numbers—**integer**

Yes/no or True/False—**boolean**

Letters, combination of letters, numbers—**string**

Arithmetic operators
+ addition
- difference
* multiplication
/ division
// integer division
% remainder of integer division
** exponentiation (to the power of)

Some common syntax errors in selection
- use if and else—no capitals
- A colon : is always required after thecondition and after else.
- Use **indentation** to indicate which statements 'belong' to the if block and the else block.
- The == operator checks for equality.
- A single = is only used in assignments

HALF TERM 4

MEDIA: VECTOR GRAPHICS

Vector Graphics – simple digital images made up of paths and shapes can be easily edited.

Used to create graphics that need a large format.

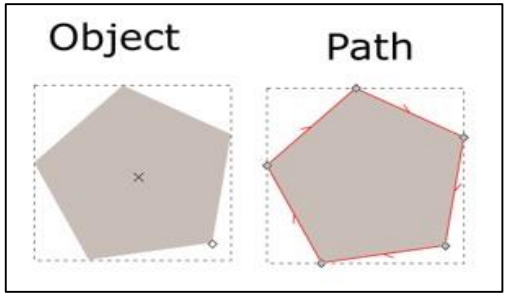
Vector graphic file sizes are usually small.

Scalable which means you can change their size without losing quality.

Bitmap images (raster graphics) – complex images made up of small individual squares of colour called pixels which can be individually edited. Used for real photographs.

File sizes are large as information about each pixel is stored. Bitmap graphics lose quality when they are resized.

The term 'path' is used because lines and shapes have a start and end point with curves and angles along the way.



The term 'path' is used because lines and shapes have a start and end point with curves and angles along the way.

Comparison	Vector Graphic	Bitmap Graphic
Consist of	Objects	Coloured pixels
File size	Small	Large
Appearance	Simple	Detailed
File format	.svg .wmp	.bmp .jpg .gif
Scalable	Quality same	Quality lost
Use	Logos, icons & illustrations	Real images & photographs

Logo - symbol used to represent an organisation or a product.
Icons – often on computer application interfaces, representing buttons or selectable features of the software.
Illustrations - simple drawings used in books, posters, and flyers.

Key words:		
Align	Distribute	Duplicate
Ellipse	Equidistant	Fill
Flip	Freehand	Group
Handles	Intersection	Move
Node	Monochrome	Object
Path	Pixels	Polygon
Raster	Rectangle	Resize
Rotate	Scalable	Segment
Select	Ungroup	Union

HALF TERM 5

MOBILE APP DEVELOPMENT

A mobile application, most commonly called an app, is a type of application software designed to run on a
mobile device, such as a smartphone or tablet computer.

App Lab is a block or text based programming language. This allows creation and sharing of apps.

The point of an app is to connect and interact with users.
App creators tend to have an idea, a problem or a task that they want to develop user an app. These can be huge or relatively small ideas.
Decomposing the problem helps us make the task less daunting and more achievable. This involves breaking down the task into smaller more manageable parts to start with.

Most computers have an environment with tiles, icons and/or menus. These allow users to interact.
This type of interface is called the **graphical user interface (GUI)** because the user interacts with images through a mouse, keyboard or touchscreen. The GUI needs careful design consideration so that the user experience is a positive one so they want to continue to use it.

Making sure the app is successful and actually does what it was intended to do is important.
Setting **success criteria** should be determined at the start of the project and can be revisited frequently.
The success criteria should be clear and easy to follow.

Evaluating and **debugging** allow for judging the quality of the app and enables errors to be corrected and improvements to be made.

Key Words	
abstraction	Identify the important aspects to start with
algorithm	Precise sequence of instructions
Application (app)	Software designed to run on a mobile device
Computational thinking	Solving problems with or without a computer
debugging	Looking at where a program might have errors or can be improved
blocks	Scratch bricks that we can use to code algorithms
decomposition	Breaking down a problem into smaller parts
execute	A computer precisely runs through the instructions
GUI	Graphical User Interface
iteration	Doing the same thing more than once
selection	Making choices
sequence	Running instructions in order
variable	Data being stored by the computer

Sequence, **selection** and **iteration** are all processes. In order for computers to perform tasks there is more that is needed. For example a computer will take an **input** (this might be automatic or via human input) which the computer will then **process** and the **output** will be visible on the computer monitor.

HALF TERM 6

REPRESENTATIONS FROM CLAY TO SILICONE

Representing information with sequences of symbols, is necessary for storing, exchanging and processing information. Information in computers must be represented in a form convenient for processing.

Humans have invented lots of different ways to code information using different sounds, symbols or even lights!

Computers represent all data, including numbers, letters, symbols, images, videos and sounds using binary numbers. All binary numbers are made up of the digits) and 1.

0s and 1s are called binary digits, or bits. All characters are represented using sequences of bits.

Computers only use the two symbols 0 and 1 because all computers are built out of electrical switched which can only be on (1) or off (0).

Multipliers or weights are the amount each digit in a sequence is worth e.g the number 30 contains three 10s and zero 1s . 10 and 1 are the multipliers or weights. Binary numbers use different multipliers or weights

To convert from binary to decimal (also known as denary) multiply each binary digit with its multiplier, then add up the products to work out the decimal number. For example in the binary number above 1 x 16 =16 4 x1 = 4 1x2 = 2 and 1x1 = 1 and 16 + 4 + 2 + 1 = 23

Key Words	
Bit (b)	The smallest unit of data. 0 or 1.
Nibble (N)	4 bits
Byte (B)	8 bits (note the difference between b and B)
Kilobyte (KB)	1000 bytes. Note KB is different from Kb.
Megabyte (MB)	1000 KB
Gigabyte (GB)	1000 MB
Terabyte (TB)	1000 GB
Petabyte (PB)	1000 MB
Binary number	A number system that contains two symbols, 0 and 1. Also known as base 2
Base 2 number system	A number system where there are only 2 digits to select from.
data	Units of information. In computing there can be different data types, including integers, characters and Boolean. Data is often acted on by instructions.
Denary (also known as decimal)	The number system you use. It contains 10 unique digits 0 to 9. Also known as decimal or base 10
Multiplier (also known as place value)	The value of the place, or position, of a digit in a number

Multipliers	128	64	32	16	8	4	2	1
Example binary number	0	0	0	1	0	1	1	1