Year 7
Computing
3. Data Representation

STUDENT	
TEACHER	
CLASS	

WORKING AT GRADE	
TERM TARGET	
YEAR TARGET	

The long answer questions in this booklet are designed to stretch and challenge you. It is important that you understand how they should be answered. You should structure your answer like this:

1st Paragraph – should explain the key term e.g. give a definition.

2nd Paragraph – should make a point (could be an advantage or disadvantage) and explain the point fully giving an example where necessary.

3rd Paragraph – should make another point (could be an advantage or disadvantage) and explain the point fully giving an example where necessary.

4th Paragraph – should make a point (could be an advantage or disadvantage) and explain the point fully giving an example where necessary.

You should have at least 1 advantage and 1 disadvantage.

Progress against termly target												
ABOVE												
ON												
BELOW												
TERM	**1**		**2**		**3**		**4**		**5**		**6**	

Learning Outcomes			
	Levels		
Lesson	**3**	**4**	**5**
1 Units of data	I know the difference between data and information.	I can analyse and evaluate data and information, and I know that poor quality data leads to unreliable results, and inaccurate conclusions.	I know the relationship between binary and file size (uncompressed).
2 Characters	I know the difference between data and information.	I can analyse and evaluate data and information, and I know that poor quality data leads to unreliable results, and inaccurate conclusions.	I know how bit patterns represent numbers and images.
3 Images	I know the difference between data and information.	I can analyse and evaluate data and information, and I know that poor quality data leads to unreliable results, and inaccurate conclusions.	I know how bit patterns represent numbers and images.
4 Sound	I know the difference between data and information.	I can analyse and evaluate data and information, and I know that poor quality data leads to unreliable results, and inaccurate conclusions.	I know that digital computers use binary to represent all data.
5 Instructions	I know the difference between data and information.	I can analyse and evaluate data and information, and I know that poor quality data leads to unreliable results, and inaccurate conclusions.	I know the concepts behind the fetch-execute cycle.
6 Assessment	Achieves a level 3 in the end of term assessment	Achieves a level 4 in the end of term assessment	Achieves a level 5 in the end of term assessment

1. Units of data

Using the table list as many components of a computer as you can and explain their purpose.

Component	Purpose

Binary data is an example of data rather than information because:

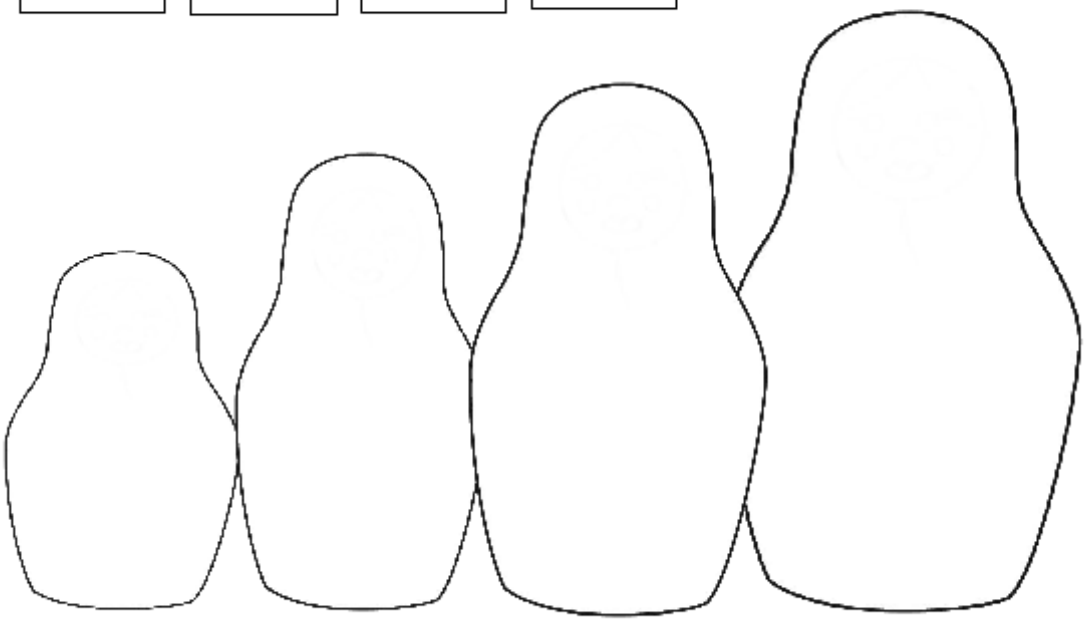
_____

_____

_____

Sort the data sizes into order of size, smallest to largest:

GB KB TB MB



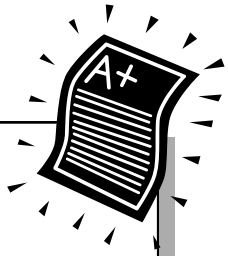
Complete the table below for each unit size

	Unit of data	Size
Smallest	Bit	0 or 1
	Nibble	4 bits
	Byte	
	Kilobyte	
	Megabyte	
	Gigabyte	
Largest	Terabyte	

What would happen if you tried to install a 4GB game on a computer than only has 3GB of space in the hard drive (HDD)?

Why is it important to look at how much space you have available on your computers hard drive before you start to install something?

Self Assessment: **R A G**	Exit Ticket: Why is binary data for a file data rather than information?

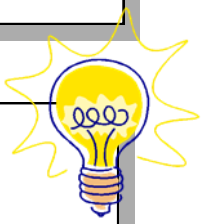


2. Characters

Complete the missing symbols and units of data.

To make it harder they are in the wrong order!

Symbol	Unit of data	Equal to	Size in Bytes	Size difference
		1,024 bytes	$2^{10} = 1024$	2.40%
		1,024 gigabytes	$2^{40} = 1,099,511,627,776$	9.95%
		1,024 megabytes	$2^{30} = 1,073,741,824$	7.37%
		1,024 kilobytes	$2^{20} = 1,048,576$	4.86%



Characters are any letter, digit or symbol that can be entered into a computer. Using only the characters on a standard keyboard create some ASCII art below:

ASCII Codes

American Standard Code for Information Interchange

ASCII control characters		
00	NULL	(Null character)
01	SOH	(Start of Header)
02	STX	(Start of Text)
03	ETX	(End of Text)
04	EOT	(End of Trans.)
05	ENQ	(Enquiry)
06	ACK	(Acknowledgement)
07	BEL	(Bell)
08	BS	(Backspace)
09	HT	(Horizontal Tab)
10	LF	(Line feed)
11	VT	(Vertical Tab)
12	FF	(Form feed)
13	CR	(Carriage return)
14	SO	(Shift Out)
15	SI	(Shift In)
16	DLE	(Data link escape)
17	DC1	(Device control 1)
18	DC2	(Device control 2)
19	DC3	(Device control 3)
20	DC4	(Device control 4)
21	NAK	(Negative acknowl.)
22	SYN	(Synchronous idle)
23	ETB	(End of trans. block)
24	CAN	(Cancel)
25	EM	(End of medium)
26	SUB	(Substitute)
27	ESC	(Escape)
28	FS	(File separator)
29	GS	(Group separator)
30	RS	(Record separator)
31	US	(Unit separator)
127	DEL	(Delete)

ASCII printable characters					
32	space	64	@	96	`
33	!	65	A	97	a
34	"	66	B	98	b
35	#	67	C	99	c
36	$	68	D	100	d
37	%	69	E	101	e
38	&	70	F	102	f
39	'	71	G	103	g
40	(	72	H	104	h
41	)	73	I	105	i
42	*	74	J	106	j
43	+	75	K	107	k
44	,	76	L	108	l
45	-	77	M	109	m
46	.	78	N	110	n
47	/	79	O	111	o
48	0	80	P	112	p
49	1	81	Q	113	q
50	2	82	R	114	r
51	3	83	S	115	s
52	4	84	T	116	t
53	5	85	U	117	u
54	6	86	V	118	v
55	7	87	W	119	w
56	8	88	X	120	x
57	9	89	Y	121	y
58	:	90	Z	122	z
59	;	91	[	123	{
60	<	92	\	124	|
61	=	93	]	125	}
62	>	94	^	126	~
63	?	95	_		

Extended ASCII characters							
128	Ç	160	á	192	└	224	Ó
129	ü	161	í	193	┴	225	ß
130	é	162	ó	194	┬	226	Ô
131	â	163	ú	195	├	227	Ò
132	ä	164	ñ	196	─	228	õ
133	à	165	Ñ	197	┼	229	Õ
134	å	166	ª	198	ã	230	µ
135	ç	167	º	199	Ã	231	þ
136	ê	168	¿	200	╚	232	Þ
137	ë	169	®	201	╔	233	Ú
138	è	170	¬	202	╩	234	Û
139	ï	171	½	203	╦	235	Ù
140	î	172	¼	204	╠	236	ý
141	ì	173	¡	205	═	237	Ý
142	Ä	174	«	206	╬	238	¯
143	Å	175	»	207	¤	239	´
144	É	176	░	208	ð	240	≡
145	æ	177	▒	209	Ð	241	±
146	Æ	178	▓	210	Ê	242	‗
147	ô	179	│	211	Ë	243	¾
148	ö	180	┤	212	È	244	¶
149	ò	181	Á	213	ı	245	§
150	û	182	Â	214	Í	246	÷
151	ù	183	À	215	Î	247	¸
152	ÿ	184	©	216	Ï	248	°
153	Ö	185	╣	217	┘	249	¨
154	Ü	186	║	218	┌	250	·
155	ø	187	╗	219	█	251	¹
156	£	188	╝	220	▄	252	³
157	Ø	189	¢	221	¦	253	²
158	×	190	¥	222	Ì	254	■
159	ƒ	191	┐	223	▀	255	nbsp

frequently-used (spanish language)	
ñ	alt + 164
Ñ	alt + 165
@	alt + 64
¿	alt + 168
?	alt + 63
¡	alt + 173
!	alt + 33
:	alt + 58
/	alt + 47
\	alt + 92

vowels acute accent (spanish language))	
á	alt + 160
é	alt + 130
í	alt + 161
ó	alt + 162
ú	alt + 163
Á	alt + 181
É	alt + 144
Í	alt + 214
Ó	alt + 224
Ú	alt + 233

vowels with diaresis	
ä	alt + 132
ë	alt + 137
ï	alt + 139
ö	alt + 148
ü	alt + 129
Ä	alt + 142
Ë	alt + 211
Ï	alt + 216
Ö	alt + 153
Ü	alt + 154

mathematical symbols	
½	alt + 171
¼	alt + 172
¾	alt + 243
¹	alt + 251
³	alt + 252
²	alt + 253
ƒ	alt + 159
±	alt + 241
×	alt + 158
÷	alt + 246

commercial / trade symbols	
$	alt + 36
£	alt + 156
¥	alt + 190
¢	alt + 189
¤	alt + 207
®	alt + 169
©	alt + 184
ª	alt + 166
º	alt + 167
°	alt + 248

quotes and parenthesis	
"	alt + 34
'	alt + 39
(	alt + 40
)	alt + 41
[	alt + 91
]	alt + 93
{	alt + 123
}	alt + 125
«	alt + 174
»	alt + 175

Brief History of ASCII code:

The American Standard Code for Information Interchange, or ASCII code, was created in 1963 by the "American Standards Associatio" Committee or "ASA", the agency changed its name in 1969 by "American National Standards Institute" or "ANSI" as it is known since.

This code arises from reorder and expand the set of symbols and characters already used in telegraphy at that time by the Bell company.

At first only included capital letters and numbers , but in 1967 was added the lowercase letters and some control characters, forming what is known as US-ASCII, ie the characters 0 through 127.
So with this set of only 128 characters was published in 1967 as standard, containing all you need to write in English language.

In 1981, IBM developed an extension of 8-bit ASCII code, called "code page 437", in this version were replaced some obsolete control characters for graphic characters. Also 128 characters were added , with new symbols, signs, graphics and latin letters, all punctuation signs and characters needed to write texts in other languages, such as Spanish.
In this way was added the ASCII characters ranging from 128 to 255.

How to use the ASCII code:

Without knowing it you use it all the time, every time you use a computer system, but if all you need is to get some of the characters not included in your keyboard should do the following, for example:

How to type a Spanish "enye", uppercase N with tilde, ÑÑE,?

On computers with Windows operating system like Win 7, Vista, Windows XP, etc., to get the letter, character, sign or symbol "Ñ":

- Press the "Alt" key on your keyboard, and do not let go.
- While keep press "Alt", on your numeric keypad

Look at the ASCII on the right—on its own without being processed by a computer this is an example of what? Why?

67, 111, 109, 112, 117, 116, 101, 114, 32, 115, 99, 105, 101, 110, 99, 101, 32, 105, 115, 32, 102, 117, 116, 33

Can you work out the ASCII value of each of these characters?

A		
z		
!		

Can you work out what character each of these ASCII values represent?

68		
64		
48		

What would your name be in ASCII?

EXTENSION: can you work out what the ASCII value would be in binary and add this to the extra column in the tables?

There is an error in my ASCII values—how would you correct this?

Why must you be accurate when using ASCII values?

Self Assessment: R A G	Exit Ticket: one digit is wrong in the data!

3. Images

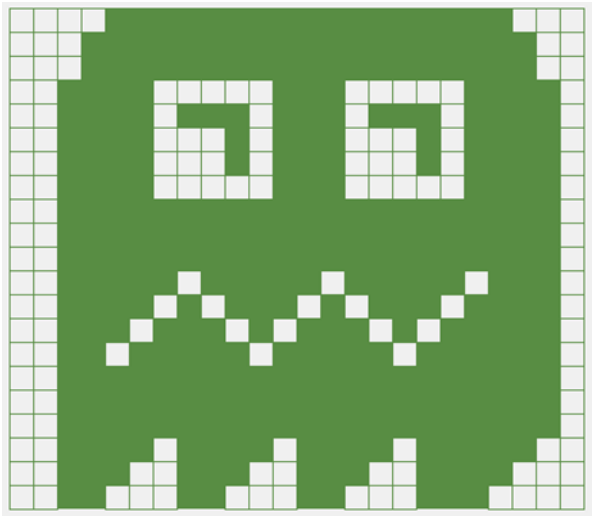
If the cell has a 1 in it colour it in black.

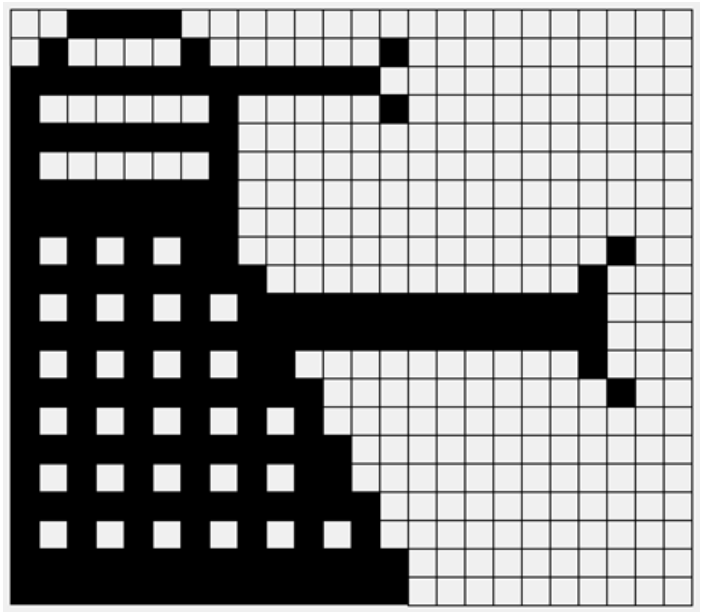
Cells with 0 in should stay white

0	0	1	0	0	0	0	0	1	0	0
0	0	0	1	0	0	0	1	0	0	0
0	0	1	1	1	1	1	1	1	0	0
0	1	1	0	1	1	1	0	1	1	0
1	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	0	1
1	0	1	0	0	0	0	0	1	0	1
0	0	0	1	1	0	1	1	0	0	0

Computers use binary to represent each pixels colour. What we have done so far is a simplified version, in reality each pixel is represented by between 8 and 32 bits depending on the colour system being used by the computer system.

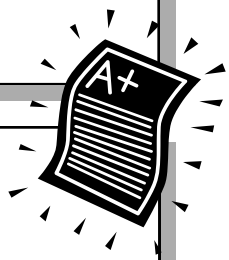
Use the spreadsheet your teacher has given to you to create the designs below.





0 0 1 0 0 0 0 0 1 0 0 is the binary number stored for the first row of pixels in the image you completed for your do it now task. Why is it important that this binary data is correct and what might happen if one 0 became a 1?

Write the binary data for an image file here, then give the data to a friend to see if they can create the image from just the data you have given them:



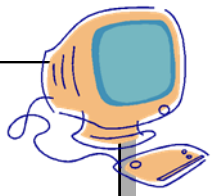
Self Assessment: **R A G**	Exit Ticket: What would happen to an image if some of the binary data was wrong?

4. Sound

Can a computer decide what colours to use in an image? Why?-

How does a computer know what colours to use?-

Today we are learning about how computers represent sounds and why the data for this must be accurate. Copy the binary below into the Python program as one continuous string when prompted.



001111000001	001111100001	010000110001	010001010001
001111000001	001111100001	010000010001	010000110010
010000110001	001111000010	010000010001	010000010001
010000110001	010000110001	010000000001	010000010001
010001010001	010000110001	010000000001	010000000001
010001010001	010000010001	001111100010	010000000001
010000110010	010000010001	001111000001	001111100001
010000010001	010000000001	001111000001	001111100001
010000010001	010000000001	010000110001	001111000010
010000000001	001111100010	010000110001	
010000000001	010000110001	010001010001	

What song does the binary data create? _____

_____

_____

Why must you be accurate when copying the data? _____

_____

_____

_____

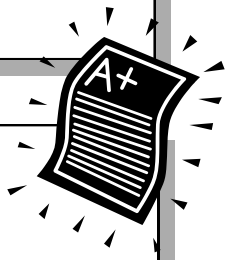
What is all data in a computer system stored as:

_____

_____

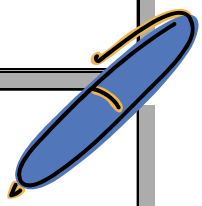
_____.

This looks like:



Self Assessment: R A G	Exit Ticket: Why is it important that binary data is accurate?

STRENGTH	TARGET	ACTION	EFFORT

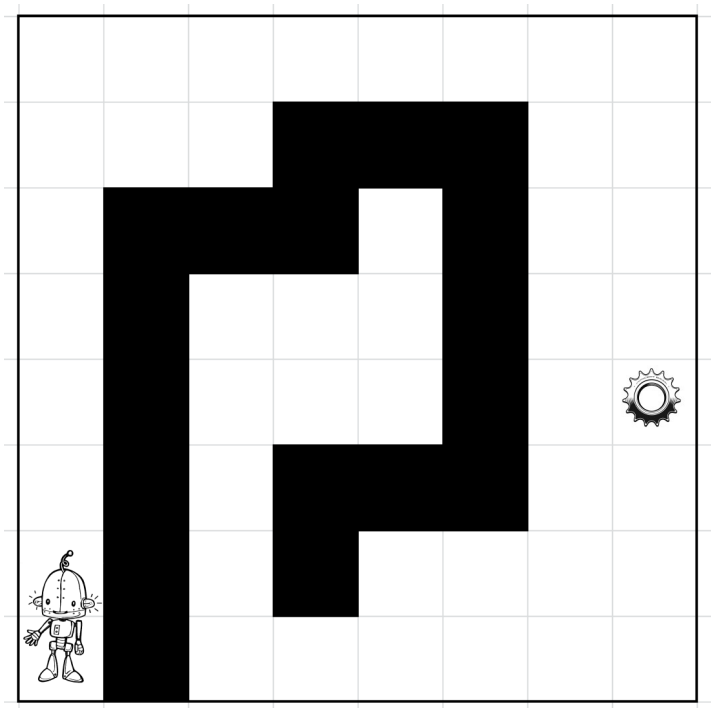


Green Pen Activity:

5. Instructions

The robot has lost one of it's cogs again and needs your help to find it.

Can you write a set of instructions that the robot can follow and find his cog, the first has been done for you.



1. Forward (6)

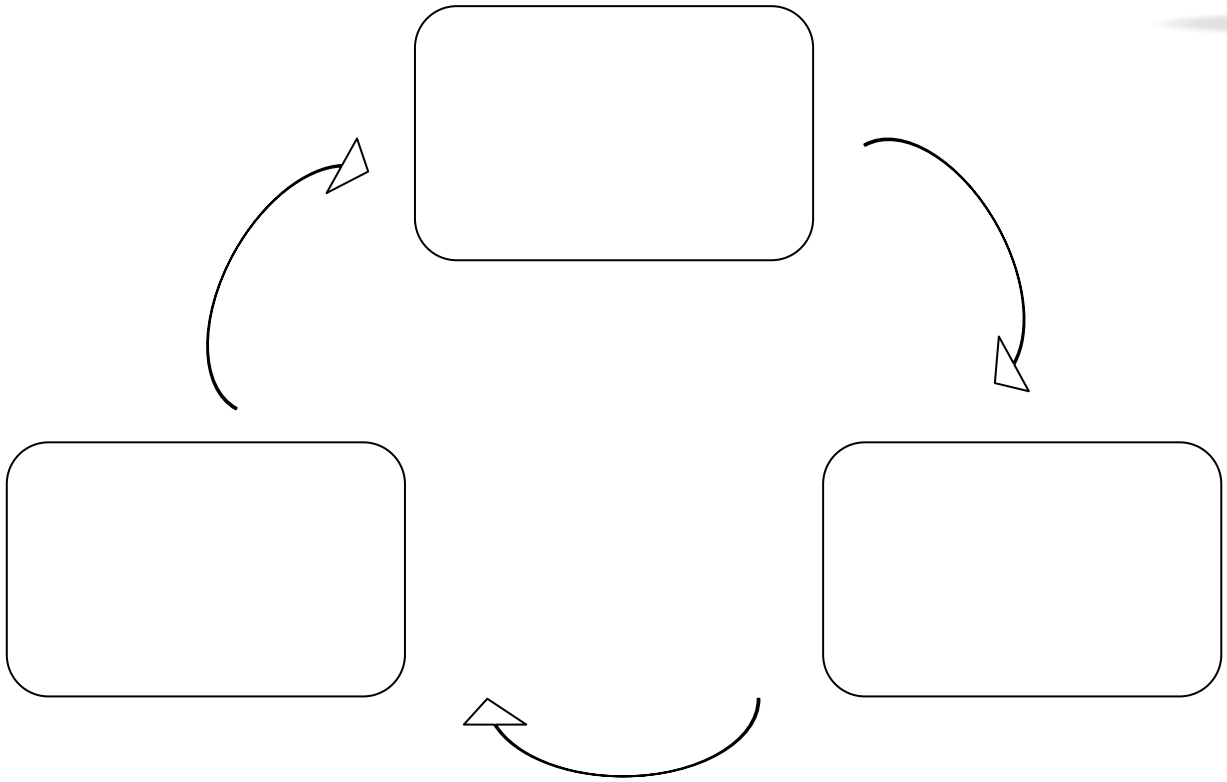
What is an instruction?

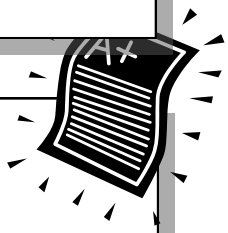
Why can a computer not make its own decisions?

What happens if any of these instructions are wrong?

Write a set of instructions for Jambot to follow:

Complete the diagram for the fetch / execute cycle , explaining each step:





Self Assessment:	Exit Ticket: What do computers follow?
R A G	

6. Assessment lesson

Data Representation

S R F G C G N K R V H J W R G K Z W W H
R E G G S K U N G I M C N P H Q U K A F
A Z T J R D L R R N D X K C S N G T S Q
T I Q T K V A C C S Z W O H I R G F C D
R N L W D P Z B X T W D E C I M A L I J
E O A D H X D S E R A M O G G P G G I I
Z I N I D D X T K U E D O C H F I X E C
V S C S C H J S Q C E J T E S T E E W I
A S C I G F I V U T I Z Q P A H N K U B
V E H O I C P L X I G B L L F O F T G I
N R A X W Z R S W O G N C P I X E L W T
R P R E U G O L A N A S I T N O C G D Y
O M A H W U V I Q O L N U L Y R A N I B
T O C W O L F R E V O L C P P H J X I O
A C T I F K K H A S O V V C N M C N K R
R A E I R G E M H S F Y J Q Z H A N Z I
E K R G R O T C E V O D T T Q R I S Q W
P V T H O P E R A N D V P K Y L T O Z M
O V E J L P A M E Q M L L I K X S X Y G
K M E T A D A T A H E X A D E C I M A L

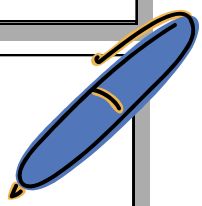
BINARY
DECIMAL
ASCII
UNICODE
METADATA
VECTOR
COMPRESSION
INSTRUCTION
OPERATOR

CODE
HEXADECIMAL
CHARACTER
BIT
PIXEL
GRAPHICS
DIGITAL
SET

BINARY
OVERFLOW
SET
MAP
RESOLUTION
ANALOGUE
SAMPLING
OPERAND

STRENGTH	TARGET	ACTION	EFFORT

Green Pen Activity:



Keywords

Binary code	The code in which all data and instructions in a computer as stored. This is made of the digits 0 and 1.
Binary	Numbers expressed in base 2.
Decimal (denary)	Numbers expressed in base 10.
Hexadecimal	Numbers expressed in base 16.
Overflow	An error caused by attempting to store a number that is too large for the number of bits available.
ASCII	American Standard Code for Information Interchange – a7-bit character code.
Character set	The complete collection of characters that can been coded in a particular coding system.
Unicode	At least 16-bit code. Defines what characters it encodes and then uses a suitable number of octets to store them as a number.
Bit map	An image file format where the picture is represented asset of dots or pixels.
Metadata	Data about data.
Pixel	'Picture cell' – a dot that makes up a part of an image. Resolution The number of dots per unit length. It affects the clarity
Resolution	The number of dots per unit length. It affects the clarity of the image.
Vector graphics	Graphics stored as formulae.
Analogue	A form of signal that can take any value between the lowest and the highest. Sound is like this.
Compression	The process of reducing a file's size by removing data.
Digital	A form of signal that is either on or off. Computer music files must be digital.
MP3 MPEG-1 or MPEG-2	P3 MPEG-1 or MPEG-2 Audio Layer III – a digital audio encoding format which uses lossy data compression. A common standard for digital music.
Sampling	The process of capturing data about the sound at intervals.
Instruction set	The total collection of instructions that a processor can carry out.
Operand	The part of an instruction that identifies the data to be handled by the operator.
Operator	The part of an instruction that tells the processor what to do.