Teaching KS3 Computing

Session 3

Theory: More on binary and representing text

Practical: Introducing IF

Queen Mary University of London

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COMPUTING AT SCHOOL
EDUCATE · ENGAGE · ENCOURAGE

KING'S College LONDON

Today's session

5:00 – 6:00

Representing text as numbers – characters and the computer

6.00 – 7.00

Programming with IF - selection

From the national curriculum

At KS3 students should be able to:

“understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits”

Computing programme of study

Storing Binary Numbers

Inside the computer each **bi**nary digi**t** is stored in a unit called a **bit**.

A series of 8 bits is called a **byte**.

A **bit** can take the values **0** and **1**

Units we use to count bits

1 byte = 8 bits

1 nibble = 4 bits

1 kilobyte = 1000 bytes

1 megabyte = 1000000 bytes = 1000 kilobytes

1 gigabyte = 1000000 kilobytes = 1000 megabytes

1 terabyte = 1000000 megabytes = 1000 gigabytes

NB Some books say 1 kilobyte = 1024 bytes – that's no longer used

Activity 1 – put these amounts of data in order from smallest to biggest

3kB

1.5 MB

12 MB

80 Bytes

2000 KB

3003 Bytes

Other number systems

Other number systems

We use base 10 — Denary number system (0,1,2,3,4,5,6,7,8,9)

Computers use base 2 — Binary number system (0,1)

What about base 16? — Hexadecimal number system

Memory test

Without writing anything down, study these two numbers for one minute and try to remember them

0111100011110101

1010111000011100

Memory test

Without writing anything down, study these two numbers for one minute and try to remember them

How did you do?

Memory test

Without writing anything down, study these two numbers for one minute and try to remember them

78F5

AE1C

Memory test

Without writing anything down, study these two numbers for one minute and try to remember them

How did you do?

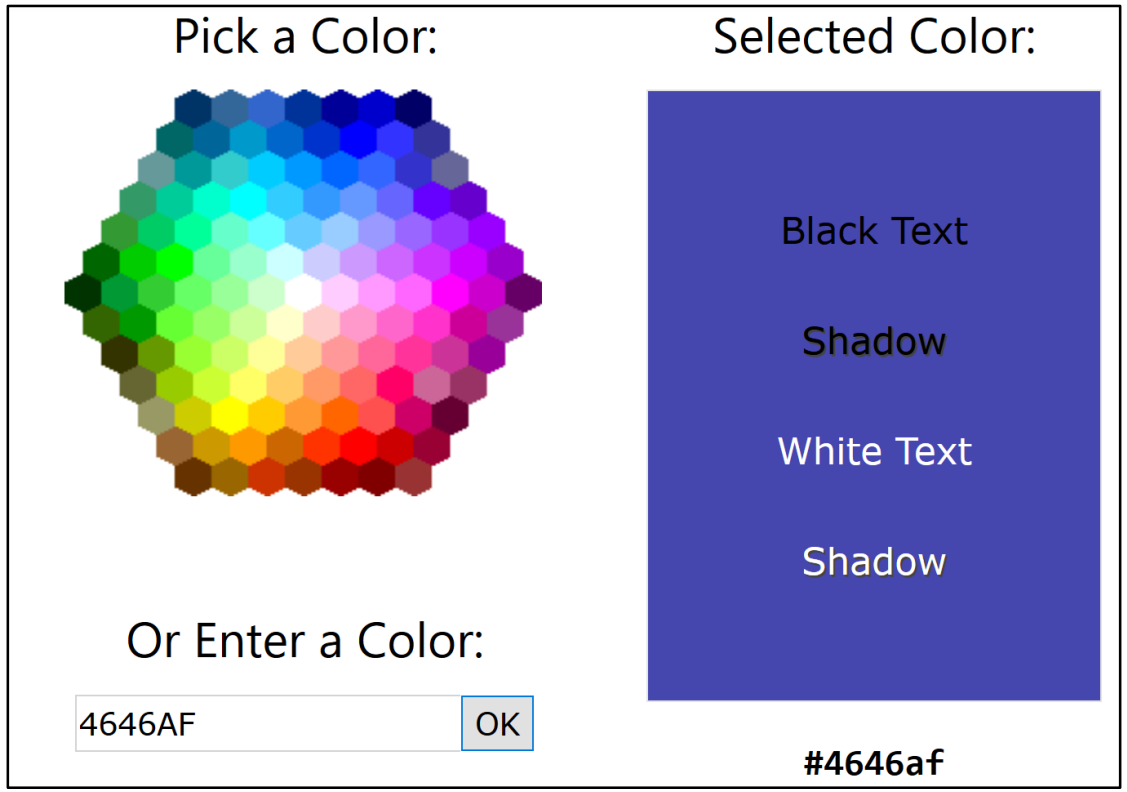
Denary	Binary	Hexadecimal
1	1	1
2	10	2
3	11	3
4	100	4
5	101	5
6	110	6
7	111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
16	10000	10

Hexadecimal (Base 16)

As shorthand for binary (easier to read and write in Hex than in binary)

Easier to convert between binary and hex than binary and denary

A convenient shorthand for colours



White is FFFFFF
Black is 000000

http://www.w3schools.com/colors/colors_picker.asp

Activity 2: Converting Hex

Convert the following hex numbers into binary (do one digit at a time):

16

A9

F0

FF

Denary	Binary	Hexadecimal
1	1	1
2	10	2
3	11	3
4	100	4
5	101	5
6	110	6
7	111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
16	10000	10

Activity 2 answers

Convert the following hex numbers into binary:

16	A9	F0	FF
0001 0110	1010 1001	1111 0000	1111 1111

What other data is stored on a computer?

Text data

Entered on a keyboard

Text data

- We talk about “storing” data on the computer when we save it
- All data needs to be converted to a form understood by the computer
- This ends up as 1s and 0s – binary code
- A coding system is needed so that each character can be represented in binary
- Two common systems are ASCII and UNICODE

Some ASCII codes

ASCII Code: Character to Binary

0	0011 0000	O	0100 1111	m	0110 1101
1	0011 0001	P	0101 0000	n	0110 1110
2	0011 0010	Q	0101 0001	o	0110 1111
3	0011 0011	R	0101 0010	p	0111 0000
4	0011 0100	S	0101 0011	q	0111 0001
5	0011 0101	T	0101 0100	r	0111 0010
6	0011 0110	U	0101 0101	s	0111 0011
7	0011 0111	V	0101 0110	t	0111 0100
8	0011 1000	W	0101 0111	u	0111 0101
9	0011 1001	X	0101 1000	v	0111 0110
A	0100 0001	Y	0101 1001	w	0111 0111
B	0100 0010	Z	0101 1010	x	0111 1000
C	0100 0011	a	0110 0001	y	0111 1001
D	0100 0100	b	0110 0010	z	0111 1010
E	0100 0101	c	0110 0011	.	0010 1110
F	0100 0110	d	0110 0100	,	0010 0111
G	0100 0111	e	0110 0101	:	0011 1010
H	0100 1000	f	0110 0110	;	0011 1011
I	0100 1001	g	0110 0111	?	0011 1111
J	0100 1010	h	0110 1000	!	0010 0001
K	0100 1011	I	0110 1001	'	0010 1100
L	0100 1100	j	0110 1010	"	0010 0010
M	0100 1101	k	0110 1011	(	0010 1000
N	0100 1110	l	0110 1100	)	0010 1001
				space	0010 0000

Activity 3: Converting text

Use the chart you have to convert this message from binary into a word

01001000 01100101 01101100 01101100 01101111

Now write your name or a short word in ASCII code

Ask your partner to decode it

Activity 4: Word Smuggler

Go to http://www.wordsmuggler.com/Smuggler

Enter a word and see how it is converted into binary code.

If time, Lego Braille

Needs: Lego Bricks!

https://teachinglondoncomputing.org/lego-braille/

- Split the class into groups. Each group should have pencils and paper to plan on. They will also need lots of lego pieces. Have students in small groups. Each group needs lots of flat 3×2 pieces to act as a base for each letter and 3 or 4 times as many small pieces for the bumps (these could be small round button-like pieces or the more normal square 1×1 bricks). Each group also needs a large base piece for a message to be laid out on is also useful.
- Explain that they must create in the group their own version of Braille, their own code so way to communicate. A single letter must be represented by a a single lego brick base with a pattern of bumps and no bumps on it. They will need to invent a special pattern for each letter of the alphabet.
- They will need to plan how each letter will be represented and ensure each is unique. They should create a poster of their code a little like those for Braille itself. Write one letter with a random pattern for its code on the board as an example.

Break