Teaching KS3 Computing

Session 2

Introduction

Theory: Binary numbers

Practical: Python Turtles and functions

Queen Mary
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COMPUTING AT SCHOOL
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From the national curriculum

At KS3, students should be able to:

understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers [for example, binary addition, and conversion between binary and decimal]

Today's session

5:00 – 6:00

Binary numbers – converting between denary and binary

6.00 – 7.00

More Python and Turtles

Binary numbers

0

Binary numbers

1

Activity 1: Binary counting exercise

How to convert Binary Numbers to denary

Place values

16	8	4	2	1
0	1	0	1	0

0   + 8   +   0 + 2   + 0   = 10   in Denary

Converting binary to denary

Another example:

Convert the binary number 1011 0111 into denary:

Answer

128	64	32	16	8	4	2	1
1	0	1	1	0	1	1	1

128 +32 +16 +4 +2 +1 = **183**

Activity 2: Conversion Exercise

Convert the following binary numbers into denary:

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

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

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

Activity 2: Conversion Exercise

Convert the following binary numbers into denary:

0 0 1	0 1 0	1 0 0 0	1 0 0 1
1	2	8	9

1 0 1	1 1 0	1 0 1 0	1 1 1 1
5	6	10	15

1 1 0 0	1 0 1 0 1	1 0 1 1 1	1 1 1 1 1
12	21	23	31

Teaching and practicing binary conversions

- Binary cards
- Online binary cards
- Finger binary
- Code.org binary game
- CS Unplugged activities

Addition Rules for Binary

0 + 0 = **0**

1 + 0 = **1**

0 + 1 = **1**

1 + 1 = **10**   (write down 0 and carry **1**)

1 + 1 + 1 = **11**   (write down 1 and carry **1**)

Adding Binary Numbers

Task: add 8 and 5

```
8      1 0 0 0
5      0 1 0 1
       ----------------

13     1 1 0 1
```

check the answer using place values: 8+4+0+1 = 13

Adding Binary Numbers

Task: add 9 and 5

```
  9        1  0  0  1
  5        0  1  0  1
         ----------------
 14        1  1  1  0
                    1
```

carry

Check the answer using place values: 8+4+2+0 = 14

Activity 3: Binary addition exercises

Summary – why teach binary?

Binary is a set of instructions used to control the computer, and works with 1s and 0s

The computer understands them as on or off signals.

If the decimal system were used, there would need to be 10 different voltages, in which case there'd be more room for error with resistors etc., and therefore more room for corruption of data.

Today, the elementary building block for all modern computer systems is the transistor. A transistor is simply a switch, much like the light switch mentioned earlier.

A transistor can be in an off state, which does not allow electricity to flow, or in an on state, in which electricity can pass unimpeded. A transistor is a solid-state device that has no mechanical or moving parts. The switching of a transistor from the off state to the on state, or vice versa, is done electronically rather than mechanically. This allows it to be fast as well as extremely small.

So learning binary helps students to understand how a computer works

Break

Next week we will look at other uses of binary numbers

After break we will continue with programming in Python