

In everyday Maths we use the decimal system of counting which is also known as base 10. Look at how it works for the number 217:

100	10	1
2	1	7

The number 217 means:

$$\begin{array}{r}
 2*100 + \\
 1*10 + \\
 \underline{7*1} \\
 217
 \end{array}$$

Each column to the left has the value of 10 times the previous column.

Computers use binary which can contain only 0 or 1. This is also known as base 2. Each column to the left has 2 times the value of the previous column. To convert the number 11011001 from binary to decimal do the following process:

1. Put the column titles in for each column:

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

2. Add each of the column titles with a 1 in it:

$$= 128 + 64 + 16 + 8 + 1 = \underline{217}$$

We can add a subscript to numbers to show which base we are using. We also put a space after every four digits of binary to make it easier to read. For example:

$$217_{10} = 1101\ 1001_2$$

This means 217 in base 10 equals 1101 1001 in base 2.

We can place as many leading zeros to a number as we like. So $0001 = 1$. Because computers store numbers of a certain length, like 8 bits, we often use leading zeros. 32 stored as an 8 bit number would be:

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

$$32_{10} = 0010\ 0000 \text{ as an 8 bit number}$$

Q 37

Binary to Decimal Conversions - Questions

1. Match the binary numbers on the left to the decimal numbers on the right.

10

3

0

1

11

0

1

2

2. Convert the following numbers from binary to decimal. [4]

a) 100 _____ [1]

b) 110 _____ [1]

c) 0000 0110 _____ [1]

d) 0001 0000 _____ [1]

e) 0010 0100 _____ [1]

f) 1111 1111 _____ [1]

10

3. What is the maximum number in decimal that can be stored in a 4 bit number? _____ [1]

4. What is the maximum number in decimal that can be stored in an 8 bit number? _____ [1]

5. What is the range of decimal numbers that an 8 bit number can store? _____ ~ _____ [1]

6. What does the 2 in the number $1011\ 0110_2$ mean? Fill in **one** circle [1]

- It is in base 10
- It is in base 2
- It is a mistake
- Multiply the number by 2

7. Convert the following numbers from binary to decimal.

a) 0101 0101 _____ [1]

b) 1010 1010 _____ [1]

c) 0000 1111 _____ [1]

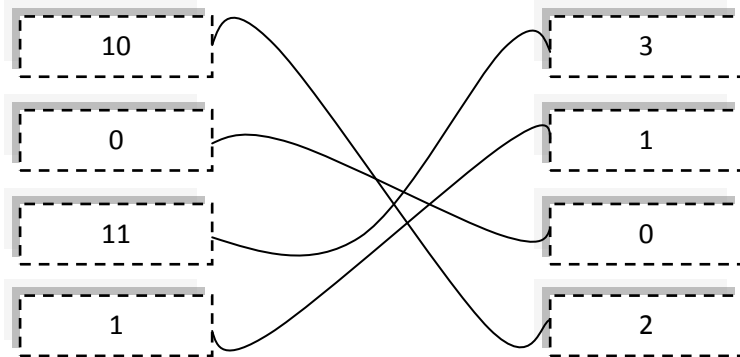
d) 1111 0000 _____ [1]

e) 1101 0010 _____ [1]

f) 0010 1101 _____ [1]

10

1. Match the binary numbers on the left to the decimal numbers on the right.



2. Convert the following numbers from binary to decimal.

- a) 100 4 [1]
- b) 110 6 [1]
- c) 0000 0110 6 [1]
- d) 0001 0000 16 [1]
- e) 0010 0100 36 [1]
- f) 1111 1111 255 [1]

10

3. What is the maximum number in decimal that can be stored in a 4 bit number? 15 [1]

4. What is the maximum number in decimal that can be stored in an 8 bit number? 255 [1]

5. What is the range of decimal numbers that an 8 bit number can store? 0 ~ 255 [1]

6. What does the 2 in the number $1011\ 0110_2$ mean? Fill in **one** circle. [1]

- It is in base 10
- It is in base 2
- It is a mistake
- Multiply the number by 2

7. Convert the following numbers from binary to decimal.

- a) 0101 0101 85 [1]
- b) 1010 1010 170 [1]
- c) 0000 1111 15 [1]
- d) 1111 0000 240 [1]
- e) 1101 0010 210 [1]
- f) 0010 1101 45 [1]

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