**Calculating the range of positive and negative integers that can be stored**

Where you have a fixed number of bits to represent a two’s complement number, you can calculate the range of numbers that can be stored i.e the lowest negative number to the highest positive number.

For example: if we had two bits then we could store 4 numbers from -2 to +1.

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| **Denary** | **2-bit Two’s complement** |
| -2 | 10 |
| -1 | 11 |
| 0 | 00 |
| 1 | 01 |

The formula to calculate the range is:

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|  -(2(bits-1)) to 2(bits-1) – 1  |

e.g. If 8 bits was used to store a number then the range would be :

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|  -(2(8-1)) to 2(8-1) – 1 = -128 to +127 |

If you find this formula too difficult to remember then you can use an easier way:

1. Calculate the total number of numbers that can be stored by using 2bits.
2. Half the number and this is the negative value
3. Reduce this number by 1 and this is the positive value

For example: What range of positive and negative numbers can be used using 16 bits?

1. 216 = 65536
2. 65536 / 2 = 32768 this is the negative value
3. 32768 – 1 = 32767 this is the positive value
4. Therefore the range of numbers that can be stored is -32768 to +32767.

**EXERCISE 1**

Here are 3 for you to try:

a) Calculate the range of two’s complement numbers that can stored using 24 bits.

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b) Calculate the range of two’s complement numbers that can stored using 7 bits.

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c) Calculate the range of two’s complement numbers that can stored using 18 bits.

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