# Floating point: normalisation

Challenge 2

Floating point numbers are normalised so that they can be stored with optimum precision. Which of the following values is **not** properly normalised?

| mantissa | exponent |
|---|---|
| 1.000000001 | 0110 |

| mantissa | exponent |
|---|---|
| 1.010011110 | 1111 |

| mantissa | exponent |
|---|---|
| 0.011101101 | 0110 |

| mantissa | exponent |
|---|---|
| 0.111010001 | 0100 |

# Floating point: number range 1

Challenge 2

A floating point number is represented by a mantissa and an exponent. Both parts are always stored as two's complement numbers.

The number of bits allocated to the **exponent** affects the **range** of the numbers that can be represented.

If 5 bits are allocated to the mantissa and 3 bits are allocated to the exponent, what is the **largest positive number** that can be represented? Give your answer as a denary (base-10) number.

Quiz:
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# Floating point: number range 2

Challenge 2

A floating point number is represented by a mantissa and an exponent. Both parts are always stored as two's complement numbers.

The number of bits allocated to the **exponent** affects the **range** of the numbers that can be represented.

If 5 bits are allocated to the mantissa and 3 bits are allocated to the exponent, what is the **smallest positive number** that can be represented? Give your answer as a denary (base-10) number.

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# Floating point: number range 4

Challenge 2

A floating point number is represented by a mantissa and an exponent. Both parts are always stored as two's complement numbers.

The number of bits allocated to the **exponent** affects the **range** of the numbers that can be represented.

If 5 bits are allocated to the mantissa and 3 bits are allocated to the exponent, what is the **smallest negative number** (the negative number that is closest to zero) that can be represented? Give your answer as a denary (base-10) number.

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# Floating point: binary to denary 1

Challenge 2

The binary number shown below is represented as a **normalised floating point number** with an 8-bit mantissa and a 4-bit exponent. The mantissa and exponent are both stored using two's complement.

| **mantissa** | | | | | | | | | | **exponent** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | . | 1 | 1 | 0 | 0 | 1 | 1 | 0 | | 0 | 1 | 0 | 0 |

Convert the floating point number into denary.

Type your answer as a **signed decimal number** (e.g. $+3.75$) - do not leave any spaces in your answer.

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# Floating point: binary to denary 3

Challenge 2

The binary number shown below is represented as a **normalised floating point number** with an 8-bit mantissa and a 4-bit exponent. The mantissa and exponent are both stored using two's complement.

| **mantissa** | | | | | | | | | | **exponent** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | . | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | 1 | 0 | 1 | 1 |

Convert the floating point number into denary.

Type your answer as a **signed decimal number**, e.g. $+3.75$ - do not leave any spaces in your answer.

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# Floating point: denary to binary 1

Challenge 2

Convert the denary number $+\frac{5}{16}$ (or $+0.3125$ as a decimal) to binary, encoding the number as a **normalised floating point number** with an 8-bit mantissa and a 4-bit exponent. The mantissa and exponent use two's complement.

Type your answer as a 12-bit binary number with the binary point (e.g. $0.11100011101$) - do not leave any spaces in your answer.

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# Floating point: denary to binary 2

Challenge 2

The denary number $-\frac{9}{64}$ (or $-0.140625$ as a decimal) has been converted to binary, and is held as a **normalised floating point number** with an 8-bit mantissa and a 4-bit exponent. The mantissa and exponent use two's complement.

Which of the following options shows the correct binary representation of the number?

| mantissa | exponent |
| --- | --- |
| 1.0111000 | 0010 |

| mantissa | exponent |
| --- | --- |
| 0.1001000 | 1110 |

| mantissa | exponent |
| --- | --- |
| 1.1101110 | 0000 |

| mantissa | exponent |
| --- | --- |
| 1.0111000 | 1110 |

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# Floating point: addition

Challenge 2

Select the correct result for the addition of binary numbers shown below. The binary number representation used is a **normalised floating point number** with an 8-bit mantissa and a 4-bit exponent. The mantissa and exponent are both stored using two's complement.

| | mantissa | exponent |
|---|---|---|
| | 01110110 | 0011 |
| + | 01001011 | 0100 |

| mantissa | exponent |
|---|---|
| 11000001 | 0111 |

| mantissa | exponent |
|---|---|
| 010000110 | 0100 |

| mantissa | exponent |
|---|---|
| 10000110 | 0100 |

| mantissa | exponent |
|---|---|
| 01000011 | 0101 |

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# Floating point: underflow

Practice 2

A computer system uses a **5-bit** mantissa and **3-bit** exponent for the representation of normalised floating-point numbers. Select which of the results below, arising from a floating point calculation, will cause a floating point **underflow**.

- $+\frac{1}{2} \times 2^{-5}$
- $+\frac{1}{2} \times 2^{-4}$
- $-1 \times 2^{3}$
- $-\frac{9}{16} \times 2^{-4}$