



1.4.1 Floating Point Binary

Q1

The numbers below are represented in floating point format with a 5-bit mantissa in two's complement followed by a 4-bit exponent in two's complement. Normalise the numbers shown below, showing your working.

a) 00011 0010

[2 marks]

- 01100 0000

b) 11110 0111

[2 marks]

- 10000 0100

Q2

The table below shows floating point numbers that are stored using 6 bits for the mantissa and 3 bits for the exponent, both in two's complement.

Tick one box in each row to state whether each number is normalised or not normalised

Binary Number	Normalised	Not normalised
010101 100	✓	
110101 111		✓
011010 010	✓	
101010 110	✓	

[4 marks]

Q3

The number below is represented in floating point format with a 5-bit mantissa in two's complement followed by a 3-bit exponent in two's complement. Calculate the denary value of the number, showing your working.

01001 010

[3 marks]





- Exponent is 2
- Shift point 2 to the right gives 010.01
- Answer: 2.25 or 9/4

Q4

The normalised floating point number 1010 1110 is stored using 4 bits for the mantissa and 4 bits for the exponent, both in two's complement.

Give the denary version of this number, showing your working.

[4 marks]

- Exponent is -2
- Shift point 2 to the left
- Pad with 1s to give mantissa 1.1101
- Answer: -0.1875 or -3/16

Q5

Show the denary number -5.25 in floating point binary form representing the mantissa and exponent in two's complement, using as few bits as possible. Show your working.

[4 marks]

- In fixed point is 1010.11
- Mantissa becomes 1.01011
- Exponent of 3
- Answer: 101011 011

Q6

Convert the denary number $1\frac{5}{8}$ (1.625) to a normalised floating point binary number using 5 bits for the mantissa and 3 bits for the exponent. Show your working

[4 marks]

- In fixed point is 01.101
- Mantissa becomes 01101 Exponent of 1
- Answer: 01101 001



**Q7**

Add together the two numbers below. Both numbers are stored in normalised floating point format, using 6 bits for their mantissa and 4 bits for their exponent which are both in two's complement.

$$\begin{array}{r} 011000 \ 0110 \\ 010100 \ 0100 \ + \\ \hline \end{array}$$

Show the result in the same format and show your working.

[5 marks]

- Exponents are 6 and 4
 - Moving the binary points give mantissas 0110000.0 and 01010.0
 - Added together gives 0111010.0
 - Normalise by moving point 6 places to the left
 - 011101 0110
-

Q8

Complete this binary subtraction. Both numbers are stored in normalised floating point format, using 6 bits for their mantissa and 4 bits for their exponent which are both in two's complement.

$$\begin{array}{r} 011010 \ 0011 \\ 010010 \ 0010 \ - \\ \hline \end{array}$$

Show the result in the same format and show your working.

[6 marks]

- Exponents are 3 and 2
 - Moving the binary points give mantissas 0110.10 and 010.010
 - Convert second number to a negative 101.110
 - Added together gives 0100.010
 - Normalise by moving point 3 places to the left
 - 010001 0011
-





Q9

A computer represents floating point binary number using a 6-bit mantissa and 4-bit exponent, both using two's complement.

Add the following three numbers together and give the answer in the format described.

010100 0010

011000 0001

100010 0010

You must show your working.

[6 marks]

- First number is 010.100
 - Second number is 01.1000
 - Third number is 100.010
 - Added together gives 000.010
 - (one mark for showing calculation with carry bits)
 - 010000 1111
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