1(a) 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]

(b) **Table 3** here 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		

Table 3

[4]

(c)

(i) Convert the hexadecimal value **B7E** to a binary number.

---

[1]

(ii) 110010101 is a binary number that is represented using sign and magnitude.

Convert this binary number to a denary number.

---

[1]

(iii) Complete this binary subtraction. Both numbers are 8-bit integer values represented using two's complement.

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

0110 1101 –

0011 0100

---

[3]

2 Convert the denary number 1⅝ (i.e. 1.625) to a normalised floating point binary number using 5 bits for the mantissa and 3 bits for the bits for the exponent. Show your working.

[3]

3(a) 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. Show the result in the same format and show your working.

```
0110000110    +
0101000100
```

[5]

(b) The floating point number 001101 0100 is stored using 6 bits for the mantissa and 4 bits for the exponent, both in two's complement. This number is not normalised.

(i) Give the normalised version of this number, showing your working.

[4]

(ii) Convert your answer to part **(i)** to denary, showing your working.

[3]

4 Show how the denary value –9.125 can be represented in normalised floating point format, using 8 bits for the mantissa and 4 bits for the exponent, both in two's complement.

[5]

5(a) Two floating point numbers are shown below. Calculate the answer of the second number subtracted from the first. You must show your working and ensure your answer is normalised.

01001100 0011 - 01001010 0010

---

[5]

(b) A floating point number is represented with a mantissa of 8-bits followed by an exponent of 4-bits, both in two's complement.

00011010 0010

(i) Identify whether or not the number is normalised.

---

[1]

(ii) State how you arrived at your answer to part (i).

---

[1]

6(a)

(i) Convert the denary number 188 to an unsigned 8-bit binary number.

---[1]

(ii) Convert the denary number 188 to hexadecimal.

---[1]

(b)

(i) Convert the denary number −44 to an 8-bit binary number with sign and magnitude representation.

---[1]

(ii) Convert the denary number −44 to an 8-bit binary number with two's complement representation.

---[1]

(c) Explain how, using bit shift, the unsigned binary number 00101100 can be divided by 4.

---[2]

END OF QUESTION PAPER