Coursework 1

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1. Convert the following binary numbers to base ten.

(a) 10

(b) 27

2. Convert the following base ten numbers to binary.

(a) 101111

(b) 1111101110001

3. Add the following binary numbers:

(a) 110100010

(b) 101100000

(c) 1001110000

4. Multiply the following binary numbers:

(a) 1001110

(b) 101010101

5. Convert the following hexadecimal numbers directly to binary.

(a) 0110101011110100

6	A	F	4
0110	1010	1111	0100

(b) 0010000010011001

2	0	9	9
0010	0000	1001	1001

6. Convert the following binary numbers directly to hexadecimal.

(a) 9B3D

1001	1011	0011	1101
9	B	3	D

(b) 488A

0100	1000	1000	1010
4	8	8	A

7.Convert the following binary number to base ten (fixed point): 1101.01

(7) 13.25

8. Convert the base ten number 23.625 to fixed point binary.

(8) 10111.101

9. Calculate how the base 10 number 25.125 is represented as a 32 bit floating point number on a computer where (as is standard) the first bit is the sign, the next 8 bits are the exponent (represented in 127 bias notation) and the remaining 23 bits represent the mantissa (with the usual normalisation).

Fixed point binary

25 =

16	8	4	2	1
1	1	0	0	1

.125 =

1/2	1/4	1/8
0	0	1

25	.125
11001	.001

$$25.125 = 11001.001$$

Move decimal 4 places

11001.001 fixed point value

$1.1001001 * 2^4$ (gives you exponent value)

$1.1001001 * 2^{100}$ = 22.125

Calculate exponent (127 bias)

$4 + 127 = 131$ (add 127 for 127 bias)

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

$$131 = 10000011$$

Calculate mantissa

$$1.1001001$$

remove the 1. always going to be a 1, add zeros to fill in rest of binary values until 23 bits big

10010010000000000000000 = Mantissa

Sign Bit	Exponent	Mantissa
0	10000011	10010010000000000000000

0 10000011 10010010000000000000000 = 25.125 = $1.1001001 * 2^{100}$

Base 10 number is represented as a 32 bit floating point number on a computer where the first bit is the sign, the next 8 bits are the exponent and the remaining 23 bits represent the mantissa as:

$$01000001110010010000000000000000$$