3. (a) 0.1101 (b) 0.11001 (c) 0.00111 (d) 0.01011
4. (a) 11010.11 (b) 10111.011
(c) 110101.0111 (d) 11010101.10111

5.3 Conversion of denary to binary

An integer denary number can be converted to a corresponding binary number by repeatedly dividing by 2 and noting the remainder at each stage, as shown below for 39_{10}

2	39	Remainder
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
	0	1

(most significant bit) → 1 0 0 1 1 1 ← (least significant bit)

The result is obtained by writing the top digit of the remainder as the least significant bit, (a bit is a **b**inary dig**it** and the least significant bit is the one on the right). The bottom bit of the remainder is the most significant bit, i.e. the bit on the left.

Thus $39_{10} = 100111_2$

The fractional part of a denary number can be converted to a binary number by repeatedly multiplying by 2, as shown below for the fraction 0.625

0.625 × 2 =	1.250
0.250 × 2 =	0.500
0.500 × 2 =	1.000

(most significant bit). 1 0 1 (least significant bit)

For fractions, the most significant bit of the result is the top bit obtained from the integer part of multiplication by 2. The least significant bit of the result is the bottom bit obtained from the integer part of multiplication by 2.

Thus $0.625_{10} = 0.101_2$

Problem 4. Convert 47_{10} to a binary number.

From above, repeatedly dividing by 2 and noting the remainder gives:

2	47	Remainder
2	23	1
2	11	1
2	5	1
2	2	1
2	1	0
	0	1

1 0 1 1 1 1

Thus $47_{10} = 101111_2$

Problem 5. Convert 0.40625_{10} to a binary number.

From above, repeatedly multiplying by 2 gives:

0.40625 × 2 =	0.8125
0.8125 × 2 =	1.625
0.625 × 2 =	1.25
0.25 × 2 =	0.5
0.5 × 2 =	1.0

0 1 1 0 1

i.e. **$0.40625_{10} = 0.01101_2$**

Problem 6. Convert 58.3125_{10} to a binary number.

The integer part is repeatedly divided by 2, giving:

2	58	Remainder
2	29	0
2	14	1
2	7	0
2	3	1
2	1	1
	0	1

1 1 1 0 1 0