Computer Organisation and Architecture

① Binary to Decimal

1) $(10111.011)_2$

$= 2^4 \times 1 + 2^3 \times 0 + 2^2 \times 1 + 2^1 \times 1 + 2^0 \times 1 + \frac{1}{2} \times 0 + \frac{1}{4} \times 1 + \frac{1}{8} \times 1$

$= 16 + 8 + 4 + 2 + 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$

$= 23.875 = (23.375)_{10}$

2) $(11011.0111)_2$

$= 2^4 + 2^3 + 2^1 + 2^0 + 2^{-2} + 2^{-3} + 2^{-4}$

$= 16 + 8 + 2 + 1 + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$

$= 27.4375 = (27.4375)_{10}$

3) $(101011.1101)_2$

$= 2^5 + 2^3 + 2^1 + 2^0 + 2^{-1} + 2^{-2} + 2^{-4}$

$= 32 + 8 + 2 + 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{16}$

$= (43.8125)_{10}$

② Decimal to Binary

1)

2	475	
2	237	1
2	118	1
2	59	0
2	29	1
2	14	1
2	7	0
2	3	1
	1	1

$$0.25 \times 2 = 0.5$$
$$0.5 \times 2 = 1.0$$

$$(475.25)_{10} = (111011011.01)_2$$

2)

2	2613	
2	1306	1
2	653	0
2	326	1
2	163	0
2	81	1
2	40	1
2	20	0
2	10	0
2	5	0
2	2	1
	1	0

$$0.45 \times 2 = 0.9$$
$$0.9 \times 2 = 1.8$$
$$0.8 \times 2 = 1.6$$
$$0.6 \times 2 = 1.2$$

$$(2613.45)_{10} = (101000110101.0111)_2$$

3)

2	198	
2	99	0
2	49	1
2	24	1
2	12	0
2	6	0
2	3	0
	1	1

$0.2943 \times 2 = 0.5886$

$0.5886 \times 2 = 1.1772$

$0.1772 \times 2 = 0.3544$

$0.3544 \times 2 = 0.7088$

$0.7088 \times 2 = 1.4176$

$$(198.2943)_{10} = (11000110.01001)_2$$