

1 a. 345_{10} is decimal value because of decimal base

$$345_{10} = 345$$

$$\begin{aligned} \text{b. } 11_2 &= 1 \times 2^1 + 1 \times 2^0 \\ &= 2 + 1 \\ &= 3_{10} \end{aligned}$$

$$\begin{aligned} \text{c. } 11_7 &= 1 \times 7^1 + 1 \times 7^0 \\ &= 7 + 1 \\ &= 8_{10} \end{aligned}$$

$$\begin{aligned} \text{d. } 1001_2 &= 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ &= 8 + 0 + 0 + 1 \\ &= 9_{10} \end{aligned}$$

$$\begin{aligned} \text{e. } 1010101_2 &= 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ &= 64 + 0 + 16 + 0 + 4 + 0 + 1 \\ &= 85_{10} \end{aligned}$$

$$\begin{aligned} \text{f. } 21_3 &= 2 \times 3^1 + 1 \times 3^0 \\ &= 6 + 1 \\ &= 7_{10} \end{aligned}$$

$$\begin{aligned} \text{g. } 122_3 &= 1 \times 3^2 + 2 \times 3^1 + 2 \times 3^0 \\ &= 9 + 6 + 2 \\ &= 17_{10} \end{aligned}$$

2 a. 1110_2

$$\begin{aligned}\text{decimal} &= 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\ &= 8 + 4 + 2 + 0 \\ &= 14_{10}\end{aligned}$$

$$\begin{aligned}\text{Hex} &= 1110_2 \\ &= 14_{10} \\ &= E_{16}\end{aligned}$$

$$\begin{aligned}\text{Oct} &= 1110_2 \\ &= 14_{10} \\ &= 16_8\end{aligned}$$

$$\begin{array}{r|l} \div 8 & \\ 14 & 1 \\ 1 & 0 \end{array} \quad \begin{array}{r} 16_8 \\ \uparrow \\ 6 \end{array}$$

b. 100100_2

$$\begin{aligned}\text{dec} &= 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\ &= 32 + 0 + 0 + 4 + 0 + 0 \\ &= 36_{10}\end{aligned}$$

$$\begin{aligned}\text{Hex} &= 100100_2 \\ &= 36_{10} \\ &= 24_{16}\end{aligned}$$

$$\begin{array}{r|l} \div 16 & \\ 36 & 2 \\ 2 & 0 \end{array} \quad \begin{array}{r} 24_{16} \\ \uparrow \\ 2 \end{array}$$

$$\begin{aligned}\text{Oct} &= 100100_2 \\ &= 36_{10} \\ &= 44_8\end{aligned}$$

$$\begin{array}{r|l} & \\ 36 & 4 \\ 4 & 0 \end{array} \quad \begin{array}{r} 44_8 \\ \uparrow \\ 4 \end{array}$$

$$c. 11010111_2$$

$$\begin{aligned} \text{dec} &= 1 \times 2^7 + 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\ &= 128 + 64 + 0 + 16 + 0 + 4 + 2 + 1 \\ &= 215_{10} \end{aligned}$$

$$\begin{aligned} \text{Hex} &= 11010111_2 \\ &= 215_{10} \\ &= D7_{16} \end{aligned}$$

$$\begin{array}{r|rr} 215 & 13 & 7 \\ 13 & 0 & D=13 \end{array}$$

$$\begin{aligned} \text{Oct} &= 11010111_2 \\ &= 215_{10} \\ &= 327_8 \end{aligned}$$

$$\begin{array}{r|rr} 215 & 26 & 7 \\ 26 & 3 & 2 \\ 3 & 0 & 3 \end{array}$$

$$d. 011101010100100_2$$

$$\begin{aligned} \text{dec} &= 0 \times 2^{14} + 1 \times 2^{13} + 1 \times 2^{12} + 1 \times 2^{11} + 0 \times 2^{10} + 1 \times 2^9 + 0 \times 2^8 + 1 \times 2^7 + 0 \times 2^6 + 1 \times 2^5 \\ &\quad + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\ &= 15012_{10} \end{aligned}$$

$$\begin{aligned} \text{Hex} &= 15012_{10} \\ &= 3AA4_{16} \end{aligned}$$

$$\begin{array}{r|rr} 15012 & 938 & 4 \\ 938 & 58 & 10=A \\ 58 & 3 & 10=A \\ 3 & 0 & 3 \end{array}$$

$$\begin{aligned} \text{Oct} &= 15012_{10} \\ &= 35244_8 \end{aligned}$$

$$\begin{array}{r|rr} 15012 & 1876 & 4 \\ 1876 & 234 & 4 \\ 234 & 29 & 2 \\ 29 & 3 & 5 \\ 3 & 0 & 3 \end{array}$$

3. a. $4E_{16}$

$$\begin{aligned}\text{dec} &= 4 \times 16^1 + 14 \times 16^0 \\ &= 64 + 14 \\ &= 78_{10}\end{aligned}$$

4	14
0100	1110

$$\text{bin} = 0100110_2$$

b. $7C_{16}$

$$\begin{aligned}\text{dec} &= 7 \times 16^1 + 12 \times 16^0 \\ &= 112 + 12 \\ &= 124_{10}\end{aligned}$$

7	12	11
0111	1100	0100

$$\text{bin} = 1111100_2$$

c. $ED3A_{16}$

$$\begin{aligned}\text{dec} &= 14 \times 16^3 + 13 \times 16^2 + 3 \times 16^1 + 10 \times 16^0 \\ &= 57344 + 3328 + 48 + 10 \\ &= 60730_{10}\end{aligned}$$

14	13	3	10
1110	1101	0011	1010

$$\text{bin} = 111011010011010_2$$

d. $403FB001_{16}$

$$\begin{aligned} \text{dec} &= 4 \times 16^7 + 0 \times 16^6 + 3 \times 16^5 + 15 \times 16^4 + 11 \times 16^3 + 0 \times 16^2 + 0 \times 16^1 \\ &\quad + 1 \times 16^0 \\ &= 1077915649_{10} \end{aligned}$$

4	0	3	F	B	0	0	1
0100	0000	0011	1111	1011	0000	0000	0001

$$\text{bin} = 100000000111111011000000000001_2$$

4. 23 bits

$$2^n \text{ numbers} = n \text{ bits}$$

$$2^{23} = 8388608 \text{ numbers}$$