Exercise 1 | Base 6 to Base 10

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a) 2245_6

$2245 \to 2\times6^3_{10} + 2\times6^2_{10} + 4\times6^1_{10} + 5\times6^0_{10}$

$432 + 72 + 24 + 5 = \boxed{533_{10}}$

b) $32.35_6 \to 3\times6^1_{10} + 2\times6^0_{10} = 20_{10}$

$3\times6^1 \to 18$, $2\times6^0 \to 2$

$\to 3\times6^{-1}_{10} + 5\times6^{-2}_{10}$

$0.50 + 0.13889 = 0.639_{10}$

$\boxed{20.639_{10}}$

Exercise 2 | Base 10 to Base 6

a) 634_{10}

6^3	6^2	6^1	6^0
216	36	6	1
2	5	3	4

$\boxed{2534_6}$

$634/216 = 2.93$

$202/36 = 5.61$

$22/6 = 3.66$

$4/1 = 4.00$

b) 29.7_{10}

6^1 6^0

↓ ↓

6 1

↓ ↓

4 5

$29/6 = \underline{4}.83 \rightarrow$ keep 4

$5/1 = \underline{5}.00 \rightarrow$ keep 5

$0.70 \times 6 = 4.2 \rightarrow$ keep 4

$0.20 \times 6 = 1.2 \rightarrow$ keep 1

$0.20 \times 6 = 1.2 \rightarrow$ Repeat

$\boxed{45.4\bar{1}_6}$

$\boxed{\text{Exercise 3}}$

a) 442_{10}

$442/2 = 0$

$221/2 = 1$

$110/2 = 0$

$55/2 = 1$

$27/2 = 1$

$13/2 = 1$

$6/2 = 0$

$3/2 = 1$

$1/2 = 1$

↓ Remainder

$\boxed{110\ 111\ 010_2} \rightarrow$ Binary

$442/8 = 55\ R\ 2$

$55/8 = 6\ R\ 7$

$6/8 = 0\ R\ 6$

$\boxed{672_8}$

↳ Octal

$16^2 = 256$; $16^1 = 16$; $16^0 = 1$

$442/16 \rightarrow 27\ R\ 10\ (A)$

$27/16 \rightarrow 1\ R\ 11\ (B)$

$1/16 \rightarrow 0\ R\ 1 \rightarrow 1$

↓

$\boxed{1BA_{16}} \rightarrow$ Hexadecimal

b) 162_{10}

$162/2 = 0$
$81/2 = 1$
$40/2 = 0$
$20/2 = 0$
$10/2 = 0$
$5/2 = 1$
$2/2 = 0$
$1/2 = 1$

$\boxed{10100010_2}$ → Binary

$162/8 = 20 R 2$
$20/8 = 2 R 4$
$2/8 = 0 R 2$

$\boxed{242_8}$ ↳ octal

$16^2 = 256$; $16^1 = 16$; $16^0 = 1$

$162/16 = 10 R 2$
$10/16 = 0 R 10 (A)$

$\boxed{A2_{16}}$ → Hexadecimal

Exercise 4

0 = Positive; 1 = Negative

a) $(-123)_{10}$

$2 \underline{|123} \to 1$
$2 \underline{|61} \to 1$
$2 \underline{|30} \to 0$
$2 \underline{|15} \to 1$
$2 \underline{|7} \to 1$
$2 \underline{|3} \to 1$
$2 \underline{|1} \to 1$

$0111\ 1011_2$ → Binary

$\boxed{1111\ 1011_2}$ 8-bit signed magnitude

Changed from 0 → 1

1(0 111 1011) → $\boxed{1000\ 0100_2}$ 8-bit one's complement

1000 0100 → 8-bit two's complement

$$\begin{array}{r} 1000\ 0100 \\ +\ 0000\ 0001 \\ \hline \boxed{1000\ 0101_2} \end{array}$$

b) $(-74)_{10}$

$2 \lfloor 74 \rightarrow 0$
$2 \lfloor 37 \rightarrow 1$
$2 \lfloor 18 \rightarrow 0$
$2 \lfloor 9 \rightarrow 1$
$2 \lfloor 4 \rightarrow 0$
$2 \lfloor 2 \rightarrow 0$
$2 \lfloor 1 \rightarrow 1$

$0100\ 1010_2$ ↳ Binary

$\boxed{11001010_2}$ 8-bit signed magnitude
↳ changed $0 \rightarrow 1$

$0100\ 1010 \longleftrightarrow \boxed{10110101_2}$ 8-bit one's complement

$10110101 \longrightarrow$ 8-bit two's complement

$$\begin{array}{r} 10110101 \\ +\ 00000001 \\ \hline \boxed{10110110_2} \end{array}$$

Exercise 5

a) $F32C_{16}$

$15 \times 16^3 + 3 \times 16^2 + 2 \times 16^1 + 12 \times 16^0$

$61440 + 768 + 32 + 12 = \boxed{62252_{10}}$

b) $FEF5_{16}$

$15 \times 16^3 + 14 \times 16^2 + 15 \times 16^1 + 5 \times 16^0$

$61440 + 3584 + 240 + 5 = \boxed{65269_{10}}$

$\boxed{\text{Exercise 6}}$

128 64 32 16 | 8 4 2 1

a) 1101 | 1011 → Two's

$$\begin{array}{r} 0010\ 0100 \\ +\qquad\qquad 1 \\ \hline 0010\ 0101 \end{array}$$

32 4 1 → 32 + 5 = 37

Since Two's complement had 1 in beginning → $\boxed{-37_{10}}$

b) 0011 0100 → Two's

$32 + 16 + 4 = \boxed{52_{10}}$