1. Convert $(1278.875)_{10}$ to its equivalent representation in the following bases:

   → Base 16 $(4FE.E)_{16}$ ✓

   → Base 8 $(2376.7)_8$ ✓

   → Base 2 $(10111111110.111)_2$ ✓

   → Base 7 $(3504.6060)_7$ ✓

   → Base 3 $(1202100.2121)_3$ ✓

SOLUTION:

Base 2 : $(1278.875)_{10}$

2	1278
2	693 – 0
2	319 – 1
2	159 – 1
2	79 – 1
2	39 – 1
2	19 – 1
2	9 – 1
2	4 – 1
2	2 – 0
	1 – 0

$0.875 \times 2 = 1.75 - 1$

$0.75 \times 2 = 1.5 - 1$

$0.5 \times 2 = 1.0 - 1$

$0.0 \times 2 = 0.0 - 0$

$\Rightarrow (0.875)_{10} = (.111)_2$

$\Rightarrow (1278)_{10} = (10011111110)_2$

$\Rightarrow (1278.875)_{10} = (10011111110.111)_2$

Base 16 : $(1278.875)_{10}$

16	1278	
16	79	− 14
	4	− 15

$0.875 \times 16 = 14.0 - 14$

$0.0 \times 16 = 0.0 - 0$

$\Rightarrow (0.875)_{10} = (.E)_{16}$

$\Rightarrow (1278)_{10} = (4FE)_{16}$

$\Rightarrow (1278.875)_{10} = (4FE.E)_{16}$

Base 8 : $(1278.875)_{10}$

8	1278	
8	159	− 6
8	19	− 7
	2	− 3

$0.875 \times 8 = 7.0 - 7$

$0.0 \times 8 = 0.0 - 0$

$\Rightarrow (0.875)_{10} = (0.7)_8$

$\Rightarrow (1278)_{10} = (2376)_8$

$\Rightarrow (1278.875)_{10} = (2376.7)_8$

Base 7 : $(1278.875)_{10}$

7	1278	
7	182	− 4
7	26	− 0
	3	− 5

$0.875 \times 7 = 6.125 - 6$

$0.125 \times 7 = 0.875 - 0$

$0.875 \times 7 = 6.125 - 6$

$\Rightarrow (1278)_{10} = (3504)_7$

$\Rightarrow (0.875)_{10} = (0.6060)_7$

$\Rightarrow (1278.875)_{10} = (3504.6060)_7$

Base : 3 $(1278.875)_{10}$

3	1278	
3	426	– 0
3	142	– 0
3	47	– 1
3	15	– 2
3	5	– 0
3	1	– 2

$0.875 \times 3 = 2.625 - 2$

$0.625 \times 3 = 1.875 - 1$

$0.875 \times 3 = 2.625 - 2$

$\Rightarrow (0.875)_{10} = (.2121)_3$

$\Rightarrow (1278)_{10} = (1202100)_3$

$\Rightarrow (1278.875)_{10} = (1202100.2121)_3$

2. **Find the Base 10 equivalents of the following numbers:**

→ $(3F1B.25)_{16}$ $(16155.14453)_{10}$ ✓

→ $(456723.75)_8$ $(155091.9531)_{10}$ ✓

→ $(1011110001110101.10011)_2$ $(48245.59375)_{10}$ ✓

→ $(31242.2314)_5$ $(2072.5344)_{10}$ ✓

→ $(31242.60)_7$ $(7674.85714)_{10}$ ✓

SOLUTION:

↳ $(3F1B.25)_{16}$ ✓

$= 3\times16^3 + F\times16^2 + 1\times16^1 + B\times16^0 + 2\times16^{-1} + 5\times16^{-2}$ ✓

$= 12288 + 3840 + 16 + 11 + 0.125 + 0.01953$

$= (16155.14453)_{10}$ ✓

↳ $(456723.75)_8$ ✓

$= 4\times8^5 + 5\times8^4 + 6\times8^3 + 7\times8^2 + 2\times8^1 + 3\times8^0 + 7\times8^{-1} + 5\times8^{-2}$ ✓

$= 131072 + 20480 + 3072 + 448 + 16 + 3 + 0.875 + 0.0781$

$= (155091.9531)_{10}$ ✓

↳ $(1011110001110101.10011)_2$

$= 1\times2^{15} + 0\times2^{14} + 1\times2^{13} + 1\times2^{12} + 1\times2^{11} + 1\times2^{10} + 0\times2^9 + 0\times2^8 + 0\times2^7$ ✓
$+ 1\times2^6 + 1\times2^5 + 1\times2^4 + 0\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0 + 1\times2^{-1} +$ ✓
$0\times2^{-2} + 0\times2^{-3} + 1\times2^{-4} + 1\times2^{-5}$ ✓ ✓

$= 32768 + 8192 + 4096 + 2048 + 1024 + 64 + 32$
$+ 16 + 4 + 1 + 0.5 + 0.0625 + 0.03125$ ✓

$= (48245.59375)_{10}$ ✓

↳ $(31242.2314)_5$

$= 3\times5^4 + 1\times5^3 + 2\times5^2 + 4\times5^1 + 2\times5^0 + 2\times5^{-1} + 3\times5^{-2} + 1\times5^{-3} + 4\times5^{-4}$

$= 1875 + 125 + 50 + 20 + 2 + 0.4 + 0.12 + 0.008 + 0.0064$

$= (2072.5344)_{10}$

↳ $(31242.60)_7$

$= 3\times7^4 + 1\times7^3 + 2\times7^2 + 4\times7^1 + 2\times7^0 + 6\times7^{-1} + 0\times7^{-2}$

$= 7203 + 343 + 98 + 28 + 2 + 0.85714 + 0$

$= (7674.85714)_{10}$

3. Convert the following numbers directly to binary without using an intermediary base:
   - → $(3E89.AC27)_{16}$ $(1111101000100 1.1010110000100111)_2$
   - → $(22144.3561)_8$ $(10010001100100.011101110001)_2$

4. Convert $(1100110111001010.1011101)_2$ to:
   - → Octal $(146712.564)_8$
   - → Hexadecimal $(CDCA.BA)_{16}$

   Don't use an intermediary base.

SOLUTION:

Consider, the following table:

Binary	Octal	Hexa decimal
0 0 0 0	0	0
0 0 0 1	1	1
0 0 1 0	2	2
0 0 1 1	3	3
0 1 0 0	4	4
0 1 0 1	5	5
0 1 1 0	6	6
0 1 1 1	7	7
1 0 0 0	10	8
1 0 0 1	11	9
1 0 1 0	12	A
1 0 1 1	13	B
1 1 0 0	14	C
1 1 0 1	15	D
1 1 1 0	16	E
1 1 1 1	17	F

Using the Table:

3. $(3E89.AC27)_{16}$

Converting each digit into its equivalent 4 bits:

↳ (16) → 3 E 8 9 . A C 2 7

(2) → 0011 1110 1000 1001 . 1010 1100 0010 0111

⇒ $(3E89.AC27)_{16} = (0011111010001001.1010110000100111)_2$

$(22144.3561)_8$

↳ (8) Converting each digit into its equivalent 3 bits:

→ 2 2 1 4 4 . 3 5 6 1

(2) → 010 010 001 100 100 . 011 101 110 001

⇒ $(22144.3561)_8 = (010010001100100.011101110001)_2$

4. $(1100110111001010.1011101)_2$

↳ Splitting the given No. into 3 Bits groups

(2) → 001 100 110 111 001 010 . 101 110 100

(8) → 1 4 6 7 1 2 . 5 6 4

⇒ $(1100110111001010.1011101)_2 = (146712.564)_8$

↳ $(1100110111001010.1011101)_2$

Splitting the given No. into 4 bits groups

(2) → 1100 1101 1100 1010 . 1011 1010

(16) → C D C A . B A

⇒ $(1100110111001010.1011101)_2 = (CDCA.BA)_{16}$

5. Complete the following tables:

Integer conversions between binary, octal, hex, decimal

Original Base	Number to convert	Base to convert to			
		Binary	Octal	Hex	Decimal
Binary	110110	110110	66	36	54
Octal	123	1010011	123	53	83
Hex	2D	101101	55	2D	45
Decimal	123	1111011	173	7B	123

SOLUTION:

First converting each No. into its decimal equivalent No. and then converting the No. into required Base equivalents.

Conversions with fractions (max 3 places of precision)

Original Base	Number to convert	Base to convert to			
		Binary	Octal	Hex	Decimal
Binary	1011.11	1011.110	13.600	B.C00	11.750
Octal	12.5	1010.101	12.500	A.A00	10.625
Hex	D.8	1101.100	15.400	D.800	13.500
Decimal	7.6	111.100	7.463	7.999	7.600

SOLUTION:

First converting each No. into its decimal equivalent No. and then converting the No. into the required Base equivalents

6. Convert the following binary numbers to their ones and twos complements:

Binary Number	1's Complement	2's Complement
a. 110011110001	001100001110	001100001111
b. 111111111111	000000000000	000000000001
c. 100000000001	011111111110	011111111111

SOLUTION:

a). For 1's complement, inverting the bits,

⇒ 001100001110

For 2's complement, adding 1 to 1's complement,

⇒ 001100001111

b). For 1's complement, inverting the bits,

⇒ 000000000000

For 2's complement, adding 1 to 1's complement,

⇒ 000000000001

c). For 1's complement, inverting the bits,

⇒ 011111111110

For 2's complement, adding 1 to 1's complement,

⇒ 011111111111