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1)  $0.110101_2$  from binary to decimal

$$\frac{1}{2} + \frac{1}{4} + \frac{0}{8} + \frac{1}{16} + \frac{0}{32} + \frac{1}{64}$$

$$\frac{32}{64} + \frac{16}{64} + 0 + \frac{4}{64} + 0 + \frac{1}{64} = \frac{53}{64}_{10}$$

2)  $8.625_{10}$  from decimal to binary and hexadecimal

Binary:  $8_{10} = 1000$ ,  $0.625_{10} = 0.125 \times 2 = 0.25$   
 $0.25 \times 2 = 0.5$   
 $0.5 \times 2 = 1.0$   
 $\therefore 1000.101$

Hexa:  $8.625 \times 16 = 138$

$\frac{138}{16} = 8 \text{ R } 10 \rightarrow A$ ,  $\frac{8}{16} = 0 \text{ R } 8$ ,  $\therefore 8.A$

3)  $210.03F_{32}$  from  $b_{32} \rightarrow$  binary  $\rightarrow$  hexadecimal

$(2 \cdot 32^2) + (10 \cdot 32^1) + (3 \cdot 32^0) = 2048 + 928 + 13 = 2989$   
 $(24 \cdot 32^1) + (3 \cdot 32^0) + (15 \cdot 32^{-1}) = 768 + 96 + 4.6875 = 868.6875$   
 $\therefore 110001100000011111_2$

Binary:  $101110101101.1100000110111_2$   
 $\underbrace{1011}_{B} \underbrace{1010}_{A} \underbrace{1101}_{D} . \underbrace{1100}_{C} \underbrace{0001}_{0} \underbrace{1101}_{D} \underbrace{1111}_{E}$

Hexa:  $BAD.CODE_{16}$

4)  $212336614_7$  to hexadecimal

$(2 \cdot 7^8) + (1 \cdot 7^7) + (2 \cdot 7^6) + (3 \cdot 7^5) + (3 \cdot 7^4) + (6 \cdot 7^3) + (6 \cdot 7^2) + (1 \cdot 7^1) + (4 \cdot 7^0) = 12648430$

$\frac{12648430}{16} = 790526 \text{ R } 14$ ,  $\frac{790526}{16} = 49407 \text{ R } 14$ ,  $\frac{49407}{16} = 3087 \text{ R } 15$ ,  $\frac{3087}{16} = 192 \text{ R } 15$ ,  $\frac{192}{16} = 12 \text{ R } 0$ ,  $\frac{12}{16} = 0 \text{ R } 12$

$EEFF0C$   
 $\therefore COFFEE_{16}$

5)  $-259062_{10}$  from decimal to 20 bit binary to 5 symbol hexadecimal

$001111100111110110 = +259062_2$

Switch all bits except last 2.

$\frac{259062}{2^8} = 1011011$

$\therefore 110000001100000001010 = -259062_2$   
 $= COCOA$

If even: 10  
 If odd: 01

6)  $-4.625$  as IEEE single precision float. Then binary and hexadecimal. Is the representation exact?

$4 = 0100$

$= 100.101$

Precision:  $127 + 2 = 129$

$.625 = 1010$

$= 1.00101 \times 2^2$

$100000001$

IEEE:  $\underbrace{1}_{\text{sign}} \underbrace{10000000}_{\text{Precision}} \underbrace{10010100000000000000}_{\text{fraction}}$

Hexa:  $C0940000$

This representation is not always exact as there is a maximum number of bits that can store numbers. If a number continues trailing past 32-bits for single-precision, it would not be exact.

0 0 0 0 = 2  
 0 0 0 1 = 6  
 0 0 1 0 = 0  
 0 0 1 1 = 9  
 0 1 0 0 = 7  
 0 1 0 1 = 1  
 0 1 1 0 = 5  
 0 1 1 1 = 4  
 1 0 0 0 = 2

	2	6	0	9	7	1	5	4	2
S0	✓	✓		✓			✓	✓	✓
S1		✓	✓	✓			✓	✓	
S2	✓	✓	✓	✓	✓		✓		✓
S3	✓		✓	✓	✓	✓		✓	✓
S4	✓	✓	✓						✓
S5	✓	✓	✓	✓			✓		✓
S6		✓	✓	✓	✓	✓	✓	✓	

D #010 or #10#

D #10# or #000

D #1#1

D #001 or #110 <sup>not</sup>

D #00# or #010

D #00# or #110 or #01#

D