

COMP273 Assignment 1 Ye Yuan 260921269

Q1.

$$\begin{aligned}
 1. \quad 0.110101_2 &= 1 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4} + 0 \times 2^{-5} + 1 \times 2^{-6} \\
 &= \frac{1}{2} + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} \\
 &= 0.828125
 \end{aligned}$$

$$\begin{array}{r}
 2. \quad 2 \overline{) 8} \\
 \quad \quad 2 \overline{) 4} \dots 0 \\
 \quad \quad 2 \overline{) 2} \dots 0 \\
 \quad \quad 2 \overline{) 1} \dots 0 \\
 \quad \quad \quad 0 \dots 1
 \end{array}
 \quad
 \begin{aligned}
 0.625 \times 2 &= 1.25 \\
 0.25 \times 2 &= 0.5 \\
 0.5 \times 2 &= 1
 \end{aligned}$$

$$\text{So } 8.625_{10} = 1000.101_2$$

$$\frac{1000}{8} \cdot \frac{1010}{A}_2 = 8.A_{16} \quad \text{by grouping.}$$

3. By grouping, using 5 bits in binary to express 1 bit in base 32.

$$2TD.03F_{32} = \frac{00010}{2} \frac{11101}{T} \frac{01101}{D} \cdot \frac{11000}{0} \frac{00011}{3} \frac{01111}{F}$$

$$\text{So } 2TD.03F_{32} = 101110101101.110000001101111_2$$

From binary to hexadecimal:

by grouping again,

$$\begin{array}{ccccccc}
 \underline{101110101101} & \underline{1100000011011110} & & & & & \\
 B & A & D & . & C & 0 & D & E
 \end{array}$$

$$\text{So } 2TD.03F_{32} = BAD.CODE_{16}$$

$$4. 212336614_7$$

$$= 2 \times 7^8 + 1 \times 7^7 + 2 \times 7^6 + 3 \times 7^5 + 3 \times 7^4 + 6 \times 7^3 + 6 \times 7^2 + 1 \times 7^1 + 4 \times 7^0$$

$$= 12648430_{10}$$

$$\begin{array}{r} 16 \overline{) 12648430} \\ 16 \overline{) 79052} \dots E \\ 16 \overline{) 49407} \dots E \\ 16 \overline{) 3087} \dots F \\ 16 \overline{) 192} \dots F \\ 16 \overline{) 12} \dots 0 \\ \underline{10} \dots C \end{array}$$

$$\text{So } 12648430_{10} = \text{COFFEE}_{16} = 212336614_7$$

$$5. 21259062_{10}$$

$$2 \overline{) 129531} \dots 0$$

$$2 \overline{) 64765} \dots 1 \quad \text{Invert the bits.}$$

$$2 \overline{) 32382} \dots 1$$

$$2 \overline{) 16191} \dots 0$$

$$2 \overline{) 8095} \dots 1$$

$$2 \overline{) 4047} \dots 1$$

$$2 \overline{) 2023} \dots 1$$

$$2 \overline{) 1011} \dots 1$$

$$2 \overline{) 505} \dots 1$$

$$2 \overline{) 252} \dots 1$$

$$2 \overline{) 126} \dots 0$$

$$2 \overline{) 63} \dots 0$$

$$2 \overline{) 31} \dots 1$$

$$2 \overline{) 15} \dots 1$$

$$2 \overline{) 7} \dots 1$$

$$2 \overline{) 3} \dots 1$$

$$2 \overline{) 1} \dots 1$$

$$0 \dots 1$$

$$259062_{10} = 00111111001111110110_2$$

Invert the bits.

$$11000000110000001001$$

The add one.

$$-259062_{10} = 11000000110000001010_2$$

Change to hexadecimal by grouping:

$$\text{COCOA}_{16} = -259062_{10}$$

6.

$4.625_{10} = 100.101_2 = 1.00101 \times 2^2$

$$\begin{array}{r} 2 \overline{) 4} \\ 2 \overline{) 2} \dots 0 \\ 2 \overline{) 1} \dots 0 \\ 0 \dots 1 \end{array}$$

$0.625 \times 2 = 1.25$

$0.25 \times 2 = 0.5$

$0.5 \times 2 = 1$

$S = 1$

$E = 2 + 127 = 129_{10} = 10000001_2$

$F = 0010100000000000000000000000$

$-4.625_{10} = \underbrace{110000001}_{\text{sign and exp}} \underbrace{0010100000000000000000000000}_{\text{fraction}}_2$

In IEEE 754

$-4.625_{10} = C0940000_{16}$ by grouping

The representation is exact.

Q2.

1.	A ₃	A ₂	A ₁	A ₀	S ₀	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	
0	0	0	0	0	1	0	1	1	1	1	0	2
1	0	0	0	1	1	1	1	0	1	1	1	6
2	0	0	1	0	0	1	1	1	1	1	1	0
3	0	0	1	1	1	1	1	1	0	1	1	9
4	0	1	0	0	1	0	1	1	1	1	0	2
5	0	1	0	1	0	0	0	1	0	0	1	1
6	0	1	1	0	1	0	1	1	1	1	0	2
7	0	1	1	1	1	1	1	0	1	1	1	6
8	1	0	0	0	1	1	1	1	0	1	1	9
9	1	0	0	1	X	X	X	X	X	X	X	
10	1	0	1	0	X	X	X	X	X	X	X	
11	1	0	1	1	X	X	X	X	X	X	X	
12	1	1	0	0	X	X	X	X	X	X	X	
13	1	1	0	1	X	X	X	X	X	X	X	
14	1	1	1	0	X	X	X	X	X	X	X	
15	1	1	1	1	X	X	X	X	X	X	X	