Floating Point and Karnaugh Map

1. Give the float (32 bit) representation of the following values. Your final answer should be in hexadecimal.

1a. Give the float (32 bit) representation of 14.125.

$$14.125_{\text{ten}} = \frac{113}{8}_{\text{ten}} = \frac{113}{2^3}_{\text{ten}} \Rightarrow 1110.001_{\text{two}} \times 2^0 \Rightarrow 1.110001_{\text{two}} \times 2^3$$

s	exponent								fraction																						
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$$\boxed{14.125_{\text{ten}} = 01000001011000100000000000000000_{\text{two}}}$$

1b. Give the float (32 bit) representation -7.53125.

$$-7.53125_{\text{ten}} = \frac{-241}{32}_{\text{ten}} = \frac{-241}{2^5}_{\text{ten}} \Rightarrow -111.10001_{\text{two}} \times 2^0 \Rightarrow -1.1110001_{\text{two}} \times 2^2$$

s	exponent								fraction																						
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$$\boxed{-7.53125_{\text{ten}} = 11000000111100010000000000000000_{\text{two}}}$$

1c. Give the float (32 bit) representation 8675.309.

$$8675.309_{\text{ten}} \approx \frac{8883516}{1024}_{\text{ten}} = \frac{8883516}{2^{10}}_{\text{ten}} \Rightarrow 10000111100011.01001111_{\text{two}} \times 2^0 \Rightarrow 1.000011110001101001111_{\text{two}} \times 2^{13}$$

s	exponent								fraction																						
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	1	1	0	1	0	0	1	1	1	1	0	0

$$\boxed{8675.309_{\text{ten}} = 01000110000001111000110100111100_{\text{two}}}$$

2. Give the decimal representation of the following 32 bit float values.

2a. Give the decimal representation of 001111110000010000000000000000000

s				exponent														fraction														
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	1	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$(-1)^s \times (1 + \text{Fraction}) \times 2^{\text{Exponent - Bias}} = (-1)^0 \times (1 + 0.00001)_{\text{two}} \times 2^{(126-127)} = 1.00001_{\text{two}} \times 2^{-1} =$

$100001_{\text{two}} \times 2^{-6} = 33_{\text{ten}} \times 2^{-6} = 0.515625_{\text{ten}}$

$\boxed{01111110000010000000000000000000_{\text{two}} = 0.515625_{\text{ten}}}$

2b. Give the decimal representation of 01000010110111100000000000000000

s				exponent														fraction														
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	0	0	1	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$(-1)^s \times (1 + \text{Fraction}) \times 2^{\text{Exponent - Bias}} = (-1)^0 \times (1 + 0.101111)_{\text{two}} \times 2^{133-127} = 1.101111_{\text{two}} \times 2^{6} =$

$1101111_{\text{two}} \times 2^{0} = 111_{\text{ten}} \times 2^{0} = 111_{\text{ten}}$

$\boxed{01000010110111100000000000000000_{\text{two}} = 111_{\text{ten}}}$

2c. Give the decimal representation of 11000010111110100100000000000000

s				exponent														fraction														
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	0	0	0	0	1	0	1	1	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$(-1)^s \times (1 + \text{Fraction}) \times 2^{\text{Exponent - Bias}} = (-1)^1 \times (1 + 0.111101001)_{\text{two}} \times 2^{133-127} = -1.111101001_{\text{two}} \times 2^{6} =$

$-1111101001_{\text{two}} \times 2^{-3} = -1001_{\text{ten}} \times 2^{-3} = -125.125_{\text{ten}}$

$\boxed{11000010111110100100000000000000_{\text{two}} = -125.125_{\text{ten}}}$

3. Give the equation (in Sum-Of-Products form) for this truth table, then use a Karnaugh map to simplify. Show your table and final equation.

$$\bar{A}BC + A\bar{B}C + ABC$$

AB \ C	0	1
00	0	0
01	0	1
11	0	1
10	0	1

$$\boxed{AC + BC}$$

4. Give the equation (in Sum-Of-Products form) for this truth table, then use a Karnaugh map to simplify. Show your table and final equation.

$$\bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}\bar{C}D + A\bar{B}C\bar{D} + AB\bar{C}D + ABC\bar{D}$$

AB \ CD	00	01	11	10
00	0	1	1	0
01	0	1	0	1
11	0	1	0	1
10	0	1	0	1

$$\boxed{\bar{C}D + \bar{A}\bar{B}D + BC\bar{D} + AC\bar{D}}$$