1)

a)
$$18.25 \Rightarrow 18 + 0.25$$

$$2^{4}x1 = 16 \qquad 0.25x2 = 0.50 \quad 0$$

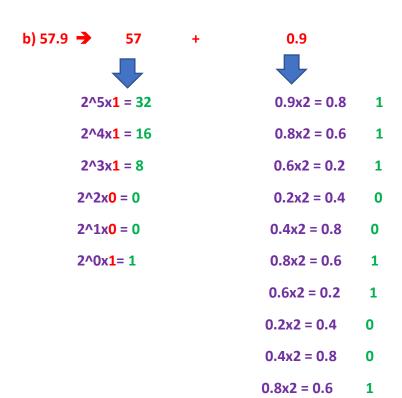
$$2^{3}x0 = 0 \qquad 0.50x2 = 1.00 \quad 1$$

$$2^{2}x0 = 0$$

$$2^{1}x1 = 2$$

$$2^{0}x0 = 0$$

$$18.25_{10} = 10010.01_{2}$$



 57.9_{10} = $111001.1\overline{1100}_2$

c) 100101.11_2

$$2^4x0 = 0$$
 $2^-2x1 = 0.25$

$$2^3x0 = 0$$

$$2^2x1 = 4$$

$$2^1x0 = 0$$

$$100101.11_2 \rightarrow 37.75_{10}$$

d) 1101. 1 $\overline{10}_2$

$$2^3x1 = 8$$
 $0.110 = x$

$$2^2x1 = 4$$
 1101.010 = 2^4x

$$2^{4}x - x = 15x = 1101.1 \rightarrow 15x = 12.5 \rightarrow x = 0.8\overline{3}$$

2^0x1= 1

$$1101.1\overline{10}_{2}$$
 \rightarrow $13.8\overline{3}_{10}$

Given,

IEEE-754 standard where,

Sign(1 bit)	Exponent(6 bits)	Mantissa(7 bits)	
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Since we have 6 bits for the exponent field we have to use Excess-31 encoding. Thus, we need to subtract 31 from the exponent field value for the decoding.

For the denormalized number, we have to use -30 as the exponent value. The encoding will be as follows:

sign	000000	mantissa
Sign	00000	manussa

a) Smallest positive subnormal number will have the following encoding:

0 000000 0000001	
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Value = 0.0000001 x 2^-30 = 2^-37

b) Largest negative subnormal number will have the following encoding:

1 000000 00	000001
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Value = -0.0000001 x 2^-30 = -2^-37

c)Largest positive subnormal number will have the following encoding:

0 000000 1111111

Value = 0. 11111111 x 2^{-30} = $(1 - 1/2^{7})$ x 2^{-30}

d) Smallest negative subnormal number will have the following encoding:

1 000000	1111111
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Value = -0. 11111111 x 2^-30 = - (1- 1/2^7) x2^-30

e) Smallest positive normalized number will have the following encoding:

0	000001	0000000
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Value = 1. 0000000 x 2^(1-31) = 1. 0000000 x 2^-30 = 2^-30

f) Largest negative normalized number will have the following encoding:

Value = -1. $0000000 \times 2^{(1-31)} = -1. 0000000 \times 2^{-30} = -2^{-30}$

g) Largest positive normalized number will have the following encoding:

0	111110	1111111
---	--------	---------

Value = 1. 11111111 x 2^(62-31) = 1. 11111111 x 2^31 = (2 -2^-7) x 2^31

h) Smallest negative normalized number will have the following encoding:

1 1	1 111110	1111111
 	111110	

Value = -1. 1111111 x 2^(62-31) = -1. 11111111 x 2^31 = -(2 -2^-7) x 2^31

i) Smallest number greater than 1 will have the following encoding:

0	011111	0000001
•	~	

Value = 1. 0000001 x 2^(31-31) = 1. 0000001 x 2^0 = 1+ 2^-7

j) Largest number smaller than 1 will have the following encoding:

0	011110	1111111	
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Value = 1. 1111111 x 2^(30-31) = 1. 11111111 x 2^-1 = 1- 2^-8

Sign	Ехр	Frac	Value	Comment
0	000000	0000001	2^-37	The smallest positive subnormal number
1	000000	0000001	-2^-37	The largest negative subnormal number
0	000000	1111111	(1-1/2^7)x2^-30	The largest positive subnormal number
1	000000	1111111	-(1-1/2^7)x2^-30	The smallest negative subnormal number
0	000001	0000000	2^-30	The smallest positive normalized number
1	000001	0000000	-2^-30	The largest negative normalized number
0	111110	1111111	(2 -2^-7) x 2^31	The largest positive normalized number
1	111110	1111111	-(2 -2^-7) x 2^31	The smallest negative normalized number
0	011111	0000001	1+ 2^-7	The smallest number greater than 1.
0	011110	1111111	1- 2^-8	The largest number smaller than 1.