Computer Architecture Tutorial 4 – Floating Point Numbers - Answers

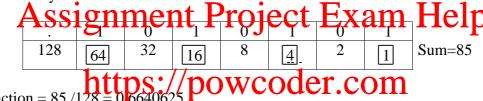
- 1) Binary fractions are:
 - a) 5.5 is **101.1**
 - b) 8.25 is **1000.01**
 - c) 9 is 1001

 $0.3 \Rightarrow 0.6, 1.2, 0.4, 0.8, 1.6, 1.2 \rightarrow 01001 1001 1001$ etc.

9.3 is **1001. 01001 1001 1001** repeating etc.

- d) 11.46875 is **1011.01111**
- 2) Convert the binary number 1001.1010101 to decimal.

1001 binary is 9 decimal



Number = 9.6640625dd WeChat powcoder

- 3) a) $101.1 = 1.011 \times 2^2$
 - b) $1000.01 = 1.00001 \times 2^3$
 - c) $0.00010101 = 1.0101 \times 2^{-4}$
- 4) Convert –31.3 to IEEE Single Precision format.

First convert to a binary number -31.3 = -11111.01001 1001 1001

Next Normalise

Significand field is 1111 0100 1100 1100 1100 110 (23 bits with 1. omitted)

Exponent field is 4+127 = 131 = 1000 0011Number is -ve therefore Sign field is 1

Sign	Exponent	Significand	
1	1000 0011	1111 0100 1100 1100 1100 110	

5) Convert the IEEE Single Precision format hex value C154 0000 to decimal.

 $C154\ 0000 = 1100\ 0001\ 0101\ 0100\ 0000\ 0000\ 0000\ 0000$

Sign	Exponent	Significand
1	1000 0010	1010 1000 0000 0000 0000 000

Exponent field = $1000\ 0010 = 130 \implies$ Exponent = 130 - 127 = 3

Significand field = 10101 Adding Hidden Bit => 1.10101

Therefore number is 1.10101 x $2^3 = 1101.01 = Decimal 13.25$

Sign is 1 therefore number is -13.25

6) Carry out the operation 31.3 + 13.25 in IEEE single precision arithmetic

Number	Sign	Exponent	Significand
31.3	0	1000 0011	1111 0100 1100 1100 1100 110
13.25	0	1000 0010	1010 1000 0000 0000 0000 000

Significand of Larger Number =

1.1010 1000 1100 1100 1100 110

Significand of Smaller Number=

Exponents differ https://exporestore.gov/accounts/finale/Maccounts/finale/

Significand of Sum = $\boxed{10.1100\ 1000\ 1100\ 1100\ 1100\ 1100}$

Sum = 10.1100 1000 1100 1100 1100 1100 x 2⁴

Normalise 1.01100 1000 1100 1100 1100 1100 x 2⁵

Sign	Exponent	Significand
0	1000 0100	0110 0100 0110 0110 0110 011

7)

Fraction	Binary	Decimal
1/4	0.01	0.25
3/8	0.011	0.375
23/16	1.0111	1.4375
45/16	10.1101	2.8125
11/8	1.011	1.375
45/8	101.101	5.625
49/16	11.0001	3.0625