ASSIGNMENT #1

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Question #1 (a)

Encode the -3.5 decimal fractional value to binary floating point notation using the 8-bit floating-point format.

Solution

As we know, if the value is negative so we put 1 (true) in the sign-bit place.

Sign		Exponent				Mantissa			
1									

Now we convert 3.5 into binary number using **power method.**

Here $3 = 2^1 + 2^0$ which is in binary **11** and $0.5 = 2^{-1}$ which is in binary **1**

2^1	2^0	Radix	2^{-1}	2^{-2}
2	1	.	1/2	1/4
1	1	.	1	0

So, -3.5 is equal to **-11.1** in binary representation, therefore our **mantissa** will be **1110**

Sign		Exponent				Mantissa			
1						1	1	1	0

Now we shift the **radix** using **excess 4 notation** by $+2$ points, so our **exponent** will be **110**

Pattern	Value
111	3
110	2
101	1
100	0
011	-1
010	-2
001	-3
000	-4

So, finally we encode -3.5 decimal fraction into binary floating-point notation as **11101110**

Answer

Sign		Exponent				Mantissa			
1		1	1	0		1	1	1	0

Question #1 (b)

Decode the **00101100** (8-bit) binary floating-point notation to decimal fractional value.

Solution

Sign		Exponent				Mantissa			
0		0	1	0		1	1	0	0

By using 8-bit binary floating-point notation, we subtracts the values as,

Sign-bit	0	(Positive)
Exponent	010	(-2)
Mantissa	1100	

Pattern	Value
111	3
110	2
101	1
100	0
011	-1
010	-2
001	-3
000	-4

Now we shift the **radix** using **right arithmetic shift** by -2 points, as **+0.111**

2^0	Radix	2^{-1}	2^{-2}	2^{-3}	2^{-4}
1	.	1/2	1/4	1/8	1/16
0	.	1	1	1	0

So, $^1/_2 = 0.5$ and $^1/_4 = 0.25$ and $^1/_8 = 0.125$

By adding all numbers, we get $0.5 + 0.25 + 0.125 = 0.875$

Answer

0.875

Question #2

Perform the binary addition on these decimal numbers, $46\,{}^{3}/_{8}$ and $92\,{}^{7}/_{8}$

Solution

First we convert $46\,{}^{3}/_{8}$ and $92\,{}^{7}/_{8}$ fractional numbers into decimals numbers,

$$46\,{}^{3}/_{8} = 46 + 0.375 = 46.375$$

$$92\,{}^{7}/_{8} = 92 + 0.875 = 92.875$$

Now we convert 46.375 into binary floating-point notation using **power method**,

2^6	2^5	2^4	2^3	2^2	2^1	2^0	Radix	2^{-1}	2^{-2}	2^{-3}
64	32	16	8	4	2	1	.	1/2	1/4	1/8
	1	0	1	1	1	0	.	0	1	1

Here, 46.375 is equivalent to **101110.011** in binary floating-point.

Now we convert 92.875 into binary floating-point,

2^6	2^5	2^4	2^3	2^2	2^1	2^0	Radix	2^{-1}	2^{-2}	2^{-3}
64	32	16	8	4	2	1	.	1/2	1/4	1/8
1	0	1	1	1	0	0	.	1	1	1

Here, 92.875 is equivalent to **1011100.111** in binary floating-point.

Now we add **101110.011** and **1011100.111** using **binary addition**

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Radix	2^{-1}	2^{-2}	2^{-3}
128	64	32	16	8	4	2	1	.	1/2	1/4	1/8
1	1	1	1	1			1		1	1	
		1	0	1	1	1	0	.	0	1	1
	1	0	1	1	1	0	0	.	1	1	1
1	0	0	0	1	0	1	1	.	0	1	0

Answer

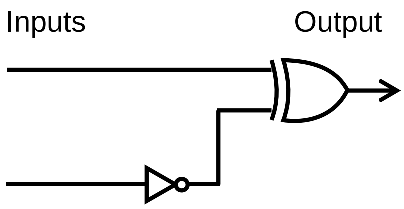
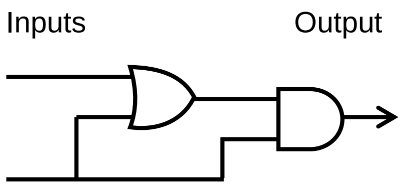
10001011.010

Question #3

The logical operations (AND, OR, NOT, and XOR etc.) discussed in the video lessons can be combined to perform some specific operations.

Two such operations (circuits) are depicted in the first column “Circuits” of the following table. You are required to determine the output of each of the following circuits for the input values given in column 2 and column 3.

Answer

Circuits	What would be the output when the upper input is 1 and the lower input is 0?	What would be the output when upper input is 0 and the lower input is 1?
	**0**	**0**
	**0**	**1**