Find the binary for the following decimal in 64-bit double precision IEEE754 format:

-10.34

Step 1: Convert the given decimal into binary form

Exponent: Divide 10 by 2

Quotient	Remainder
5	0
2	1
1	0

Mantissa: Multiply 0.34 by 2

0.34*2 =	0		0.64*2 =	1
0.68*2 =	1		0.28*2 =	0
0.36*2 =	0		0.56*2 =	1
0.72*2 =	1		0.12*2 =	0
0.44*2 =	0		0.24*2 =	0
0.88*2 =	1		0.48*2 =	0
0.76*2 =	1		0.96*2 =	1
0.52*2 =	1		0.92*2 =	1
0.04*2 =	0		0.84*2 =	1
0.08*2 =	0		0.68*2 =	1
0.16*2 =	0		0.36*2 =	0
0.32*2 =	0		0.72*2 =	1
0.64*2 =	1	*Repeating!*	0.44*2 =	0
0.28*2 =	0		0.88*2 =	1
0.56*2 =	1		0.76*2 =	1
0.12*2 =	0		0.52*2 =	1
0.24*2 =	0		0.04*2 =	0
0.48*2 =	0		0.08*2 =	0
0.96*2 =	1		0.16*2 =	0
0.92*2 =	1		0.32*2 =	0
0.84*2 =	1		0.64*2 =	1
0.68*2 =	1		0.28*2 =	0
0.36*2 =	0			
0.72*2 =	1			
0.44*2 =	0			
0.88*2 =	1			
0.76*2 =	1			
0.52*2 =	1			
0.04*2 =	0			
0.08*2 =	0			
0.16*2 =	0			
0.32*2 =	0			

Decimal:			10		.	34
Binary:	1	0	1	0	.	0101 0111 0000 1010 0011 1101 0111 0000 1010 0011 1101 0111 0000...

Step 2: Represent the obtained binary in scientific notation

In scientific notation, a float binary is written in a form so that it begins with "1."
Hence, we must move the point 3 places to the *left* in the obtained binary.

We have,

| 1 | 0 | 1 | 0 | . | 0101 0111 0000 1010 0011 1101 0111 0000 1010 0011 1101 0111 0000... |

After bit-shifting,

| 1 | . | 0 | 1 | 0 | 0101 0111 0000 1010 0011 1101 0111 0000 1010 0011 1101 0111 0000...*2^3 |

Step 3: Convert the scientific notation into 64-bit double precision IEEE754 format

We need to represent the power of 2, 3 in our case, in bits. As per the IEEE rules, we must add a
bias to the power, and then represent the resultant in bits. In 64-bit format,

Bias: 1023

=>   Exponent = 1023 + 3 = 1026

Binary of 1026:

Quotient	Remainder
513	0
256	1
128	0
64	0
32	0
16	0
8	0
4	0
2	0
1	0

Now we can represent the exponent in 11 bits as per the 64-bit IEEE format.

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

So in double precision, -10.34 is represented as:

Sign	Exponent	Mantissa
1	10000000010	0100101011100001010001111010111000010100011110101110

Convert the binary into hexadecimal

Let's consider the above binary in *groups of 4 from the right* , and find the equivalent hex for each.

Mantissa

Binary	1110	1010	0111	0100	0001	1110	1010	0111	0100	0001	1110	1010	0100
Dec	14	10	7	4	1	14	10	7	4	1	14	10	4
Hex	E	A	7	4	1	E	A	7	4	1	E	A	4

Exponent and Sign

Binary	0010	0000	1100
Dec	2	0	12
Hex	2	0	C

Answer:

C	0	2	4	A	E	1	4	7	A	E	1	4	7	A	E

Sign	1		
	1		
	0		
	0		
	0		
	0		
Exponent	0		
	0		
	0		
	0		
	1		
	0		
	0	$2^{\wedge} -1$	0
	1	$2^{\wedge} -2$	0.25
	0	$2^{\wedge} -3$	0
	0	$2^{\wedge} -4$	0
	1	$2^{\wedge} -5$	0.03125
	0	$2^{\wedge} -6$	0
	1	$2^{\wedge} -7$	0.0078125
	0	$2^{\wedge} -8$	0
	1	$2^{\wedge} -9$	0.001953125
	1	$2^{\wedge} -10$	0.0009765625
	1	$2^{\wedge} -11$	0.00048828125
	0	$2^{\wedge} -12$	0
	0	$2^{\wedge} -13$	0
	0	$2^{\wedge} -14$	0
	0	$2^{\wedge} -15$	0
	1	$2^{\wedge} -16$	0.0000152587890625
	0	$2^{\wedge} -17$	0
	1	$2^{\wedge} -18$	0.000003814697265625
	0	$2^{\wedge} -19$	0
	0	$2^{\wedge} -20$	0
	0	$2^{\wedge} -21$	0
	1	$2^{\wedge} -22$	0.0000002384185791015625
	1	$2^{\wedge} -23$	0.00000011920928955078125
	1	$2^{\wedge} -24$	0.000000059604644775390625

	1	2^ -25	0.0000000298023223876953125
Mantissa	0	2^ -26	0
	1	2^ -27	0.00000000745058059692328125
	0	2^ -28	0
	1	2^ -29	0.00000000186264514923095703125
	1	2^ -30	0.000000000931322574615478515625
	1	2^ -31	0.0000000004656612873077392578125
	0	2^ -32	0
	0	2^ -33	0
	0	2^ -34	0
	0	2^ -35	0
	1	2^ -36	0.00000000001455191522836685180664 0625
	0	2^ -37	0
	1	2^ -38	0.0000000000036379788070917129516 6015625
	0	2^ -39	0
	0	2^ -40	0
	0	2^ -41	0
	1	2^ -42	0.0000000000002273736754432320594 78759765625
	1	2^ -43	0.0000000000001136868377216160297 393798828125
	1	2^ -44	0.0000000000000568434188608080148 6968994140625
	1	2^ -45	0.0000000000000284217094304040074 34844970703125
	0	2^ -46	0
	1	2^ -47	0.0000000000000071054273576010018 5871124267578125
	0	2^ -48	0
	1	2^ -49	0.0000000000000017763568394002504 646778106689453125
	1	2^ -50	0.0000000000000008881784197001252 3233890533447265625
	1	2^ -51	0.0000000000000004440892098500626 161694526672363281250
	0	2^ -52	0

0.29249999999999998223643160599749535322189331 0546875   Sum

Cross-verification:

The above sum is in IEEE format, so it must be converted to decimal. The standard
formula for the same:

      $(-1)^{sign} * (1 + mantissa) * 2^{exponent}$

=> $(-1)^1 * (1 + 0.2924999999999999822364316059974953532218933105 46875) * 2^3$

=   -1.2924999999999999822364316059974953532218933105 46875 * 8

=   **-10.3399999999999985789145284797996282577514648 4375**