Tutorial – Week2

Q1. Covert the hexadecimal number to equivalent binary number:

$$F9A3$$

Answer:

Step 1: convert to decimal:

F = 15.

A = 10.

Step 2: count from 8, 4, 2, 1, setting the bits in that order to add up to the number.

$15 = 8 + 4 + 2 + 1, (1111)_2$

$9 = 8 + 1, (1001)_2$

$10 = 8 + 2$, so $(1010)_2$

$3 = 2 + 1$, so $(0011)_2$

Step 3: combine them as the equivalent binary number:

$$(1111\ 1001\ 1010\ 0011)_2$$

Q2. Perform subtraction $89 - 3B$, both are Hex.

Answer:

Step 1: convert to $89\ (Hex)$ and $3B$ equivalent binary number:

$$89 = (1000\ 1001)_2$$

$$3B = (0011\ 1011\ )_2$$

Step 2: convert $(0011\ 1011\ )_2$ to the 2's complement

The 2's complement of $(0011\ 1011\ )_2$ is $(1100\ 0101)_2$.

Step 3: perform 2's complement addition:

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    1000 1001
+   1100 0101
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 1  0100 1110
```

MSB 1 is the overflow bit.

Step 4: covert $(0100\ 1110)_2$ to equivalent hexadecimal number: 4E.

Q3. Perform multiplication $2\ (Hex)\ \times\ B$.

Answer:

Computer performs multiplication in an addition manner.

Step 1: covert $2\ (Hex)$ and B to equivalent binary number:

$$2 = (0010)_2$$

$$B = (1011)_2$$

Step 2: start with the first digit, in this case 1, and multiply $(0010)_2$ by $(1)_2$.

	0010
×	1011
$(0010)_2 \times (1)_2$	0010

Step 3: move to the second digit and proceed to do the same. Since it's also 1, the number will remain intact, we just need to shift the number one digit to the left.

	0010
×	1011
$(0010)_2 \times (1)_2$	0010
Second digit multiplication shifts one digit	0010

Step 4: since the third digit is a 0, we can skip it.

Step 5: Later, move to the last digit and proceed to do the same. Then start with the addition:

	0010	
×	1011	
$(0010)_2 \times (1)_2$	0010	
Second digit multiplication shifts one digit	0010	
	0010	+
	0010110	

So, the result of $2 \times B$ is $(0001\ 0110)_2 = 16\ (Hex)$

Q4. Find the 8 bits floating point representation in scientific notation form, with 3 bits as exponent, MSB is sign bit

a. $(3.75)_{10}$ to floating point representation.
b. $(0.1101\ [011])_2$ to decimal.

a. $(3)_{10} = (0011)_2$, $(0.75)_{10} = (.11000)_2$
$(3.75)_{10} = (0011.11)_2$

1 sign bit, 4 mantissa bits, 3 exponent bits (8 bits)
So, it means the $(3.75)_{10}$ or $(11.11)_2$ (4 bits mantissa) can become $(0.1111)_2$ by shifting the exponents in 2 places to the left. This implies exponent in the 3 bits is $(2)_{10}$, or $(010)_2$

$$(3.75)_{10} = ([0].[1111][010])_2$$

b. $([0].[1101][011])_2$
Positive number, mantissa is 0.1101, exponent is +ve, 3 means move the radix point to right by 3 places

$(0.1101)_2$ then becomes $(0110.0)_2$ or $(110.1)_2 = 6.5$