Course Name: COMPUTER ARCHITECTURE AND ASSEMBLY LAB

Course Number and Section: **14:332:333:01**

Experiment: Lab # 1 – Introduction, GitHub Tutorial, Number Representation – Lab Report

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GRADE: _____

COMMENTS:

1.1

a.

- Given: 0b10001110

  Calculating Decimal:

  $(0 * 2^0) + (1 * 2^1) + (1 * 2^2) + (1 * 2^3) + (0 * 2^4)$

  $+(0 * 2^5) + (0 * 2^6) + (1 * 2^7) = 142$

  Calculating Hex:

  $\frac{142}{16} = 8 + 14 = 8E$

- Given: 0xC3BA

  Calculating Decimal:

  $(10 * 16^0) + (11 * 16^1) + (3 * 16^2) + (12 * 16^3) = 50106$

  Calculating Binary:

  $\frac{50106}{2} = 25053 + 0$

  $\frac{25053}{2} = 12526 + 1$

  $\frac{12526}{2} = 6263 + 0$

  $\frac{6263}{2} = 3131 + 1$

  $\frac{3131}{2} = 1565 + 1$

  $\frac{1565}{2} = 782 + 1$

$$\frac{782}{2} = 391 + 0$$

$$\frac{391}{2} = 195 + 1$$

$$\frac{195}{2} = 97 + 1$$

$$\frac{97}{2} = 48 + 1$$

$$\frac{48}{2} = 24 + 0$$

$$\frac{24}{2} = 12 + 0$$

$$\frac{12}{2} = 6 + 0$$

$$\frac{6}{2} = 3 + 0$$

$$\frac{3}{2} = 1 + 1$$

$$\frac{1}{2} = 0 + 1$$

$$1100001110111010$$

- Given: 81

  Calculating Hex:

  $$\frac{81}{16} = 5 + 1$$

  $$\frac{5}{16} = 0 + 5$$

  $$51$$

Calculating Binary:

$\frac{81}{2} = 40 + 1$

$\frac{40}{2} = 20 + 0$

$\frac{20}{2} = 10 + 0$

$\frac{10}{2} = 5 + 0$

$\frac{5}{2} = 2 + 1$

$\frac{2}{2} = 1 + 0$

$\frac{1}{2} = 0 + 1$

1010001

- Given: 0b100100100

  Calculating Decimal:

  $(0 * 2^0) + (0 * 2^1) + (1 * 2^2) + (0 * 2^3) + (0 * 2^4)$

  $+(1 * 2^5) + (0 * 2^6) + (0 * 2^7) + (1 * 2^8) = 292$

  Calculating Hex:

  $\frac{292}{16} = 18 + 4$

  $\frac{18}{16} = 1 + 2$

  $\frac{1}{16} = 0 + 1$

124

- Given: 0xBCA1

  Calculating Decimal:

  $(1 * 16^0) + (10 * 16^1) + (12 * 16^2) + (11 * 16^3) = 48289$

  Calculating Binary:

  $\frac{48289}{2} = 24144 + 1$

  $\frac{24144}{2} = 12072 + 0$

  $\frac{12072}{2} = 6036 + 0$

  $\frac{6036}{2} = 3018 + 0$

  $\frac{3018}{2} = 1509 + 0$

  $\frac{1509}{2} = 754 + 1$

  $\frac{754}{2} = 377 + 0$

  $\frac{377}{2} = 188 + 1$

  $\frac{188}{2} = 94 + 0$

  $\frac{94}{2} = 47 + 0$

  $\frac{47}{2} = 23 + 1$

$\frac{23}{2} = 11 + 1$

$\frac{11}{2} = 5 + 1$

$\frac{5}{2} = 2 + 1$

$\frac{2}{2} = 1 + 0$

$\frac{1}{2} = 0 + 1$

1011110010100001

- Given: 0

  Calculating Hex:

  0

  Calculating Binary:

  0

- Given: 42

  Calculating Hex:

  $\frac{42}{16} = 2 + A$

  $\frac{2}{16} = 0 + 2$

  2A

Calculating Binary:

$\frac{42}{2} = 21 + 0$

$\frac{21}{2} = 10 + 1$

$\frac{10}{2} = 5 + 0$

$\frac{5}{2} = 2 + 1$

$\frac{2}{2} = 1 + 0$

$\frac{1}{2} = 0 + 1$

101010

- Given: 0xBAC4

  Calculating Decimal

  $(4 * 16^0) + (12 * 16^1) + (10 * 16^2) + (11 * 16^3)$

  47812

  Calculating Binary

  $\frac{47812}{2} = 23906 + 0$

  $\frac{23906}{2} = 11953 + 0$

  $\frac{11953}{2} = 5976 + 1$

  $\frac{5976}{2} = 2988 + 0$

$$\frac{2988}{2} = 1494 + 0$$

$$\frac{1494}{2} = 747 + 0$$

$$\frac{747}{2} = 373 + 1$$

$$\frac{373}{2} = 186 + 1$$

$$\frac{186}{2} = 93 + 0$$

$$\frac{93}{2} = 46 + 1$$

$$\frac{46}{2} = 23 + 0$$

$$\frac{23}{2} = 11 + 1$$

$$\frac{11}{2} = 5 + 1$$

$$\frac{5}{2} = 2 + 1$$

$$\frac{2}{2} = 1 + 0$$

$$\frac{1}{2} = 0 + 1$$

1011101011000100

b.

- $2^{14} = 2^4 * 2^{10} = 16Ki$
- $2^{43} = 2^3 * 2^{40} = 8Ti$
- $2^{23} = 2^3 * 2^{20} = 8Mi$

- $2^{58} = 2^8 * 2^{50} = 256Pi$
- $2^{64} = 2^4 * 2^{60} = 16Ei$
- $2^{42} = 2^2 * 2^{40} = 4Ti$

c.

- $2Ki = 2^1 * 2^{10} = 2^{11}$
- $512Pi = 2^9 * 2^{50} = 2^{59}$
- $256Ki = 2^8 * 2^{10} = 2^{18}$
- $32Gi = 2^5 * 2^{30} = 2^{35}$
- $64Mi = 2^6 * 2^{20} = 2^{26}$
- $8Ei = 2^3 * 2^{60} = 2^{63}$

2.2

1. Largest integer would be 11111111. Largest plus one would be 100000000.

2. 0 would be represented as 00000000. 3 would be represented as 00000011. For -3, you flip the 1s to 0s, 0s to 1s, and add 1. So, -3 would be represented as 11111101.

3. 42 would be represented as 00101010. Following the steps described before, -42 would be represented as 11010110.

4. 11111111

5. Let's use the values for 3 and -3 that we found before. Below you can see that the inversion trick is valid. We do have the extra 1 carryover, this results in overflow.

```
 11111111
  00000011
+11111101
  00000000
```

6. Decimal is understood by humans, binary is understood by computers, and hex bridges the gap by making binary numbers easier to read for humans.

3.1

1. A very large uncountable number of bits due to the precision of pi and Euler's number.

3. Again a very large uncountable number of bits.