# Lecture 3 Activity Solution

## Model 0 : Review of Addition / Positive

1. 10110

2. 5

3. Number of bits in the result is more than number of bits of operands

4. 0110

## Model 0: Review of Negative Integers

1. Sign-bit 0

2.

| Bits | Most Positive | Most Negative |
|---|---|---|
| 1 | 0 | -1 |
| 2 | 1 | -2 |
| 3 | 3 | -4 |
| 4 | 7 | -8 |

3. (2^(N-1)) – 1

4. -(2^(N-1))

5. Result is 10011111. Unsigned is expected result, but signed is not the expected result

6. No. However, there was a difference in the expected results that sourced from overflow and sign extension, not the action of the adders themselves.

## Model 1: Bit-Level Operations

1. 0x3501, 0xC3C3, 0xFFFF

2.

| OP0 | OP1 | AND | OR | XOR |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 |

3.

| Dec | Bin | X & 0x1 |
|---|---|---|
| -2 | 1110 | 0000 |
| -1 | 1111 | 0001 |
| 0 | 0000 | 0000 |
| 1 | 0001 | 0001 |
| 2 | 0010 | 0000 |

4. They are odd and non-zero numbers

5. Checks if the required FLAG bit is set in X

6. OR (|) sets the relevant bits in the file access modes

7. True for all

**Model 2: Logical Operations**

1. 1 value is False and 15 values are True

2. False

3. Does not hold for -1 and 2

| X | !X | !!X |
|---|---|---|
| -1 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 2 | 0 | 1 |

4. Yes. They differ. Now every (~(~X)) == X

**Model 3: Multiplication and Division**

1.

| Value | << | Result |
|---|---|---|
| 0x30 | 0 | 0x60 |
| 0x5A | 4 | 0x5A0 |
| 0x11D | 31 | 0x80000000 |

2. Decimal – 6. Binary – 0110

3. Largest 3-bit integer – 7
Value squared – 49
No. of bits required – 6

4. 1

5.

| Value | >> | Result |
|---|---|---|
| 0x30 | 1 | 0x18 |
| 0x5A | 4 | 0x5 |
| 0x11 | 3 | 0x2 |

6. Division by 2^N, where N is the no. of bits to be shifted

7. -1 (when we shift right)

8. -2 = 1110
-2 >> 1 = 1111

9. 0xA >> 1 = 0x5

10.
```
while (x != 0)
{
int rem = x &0x1 ;
x = x >> 1;
}
```