

ASSIGNMENT-1

1. Draw a table for 4-bit binary values like the following example table with unsigned and signed value.

| bits | unsigned | signed |
|------|----------|--------|
| 000 | 0 | 0 |
| 001 | 1 | 1 |
| 010 | 2 | 2 |
| 011 | 3 | 3 |
| 100 | 4 | -4 |
| 101 | 5 | -3 |
| 110 | 6 | -2 |
| 111 | 7 | -1 |

Then use signed binary to calculate:

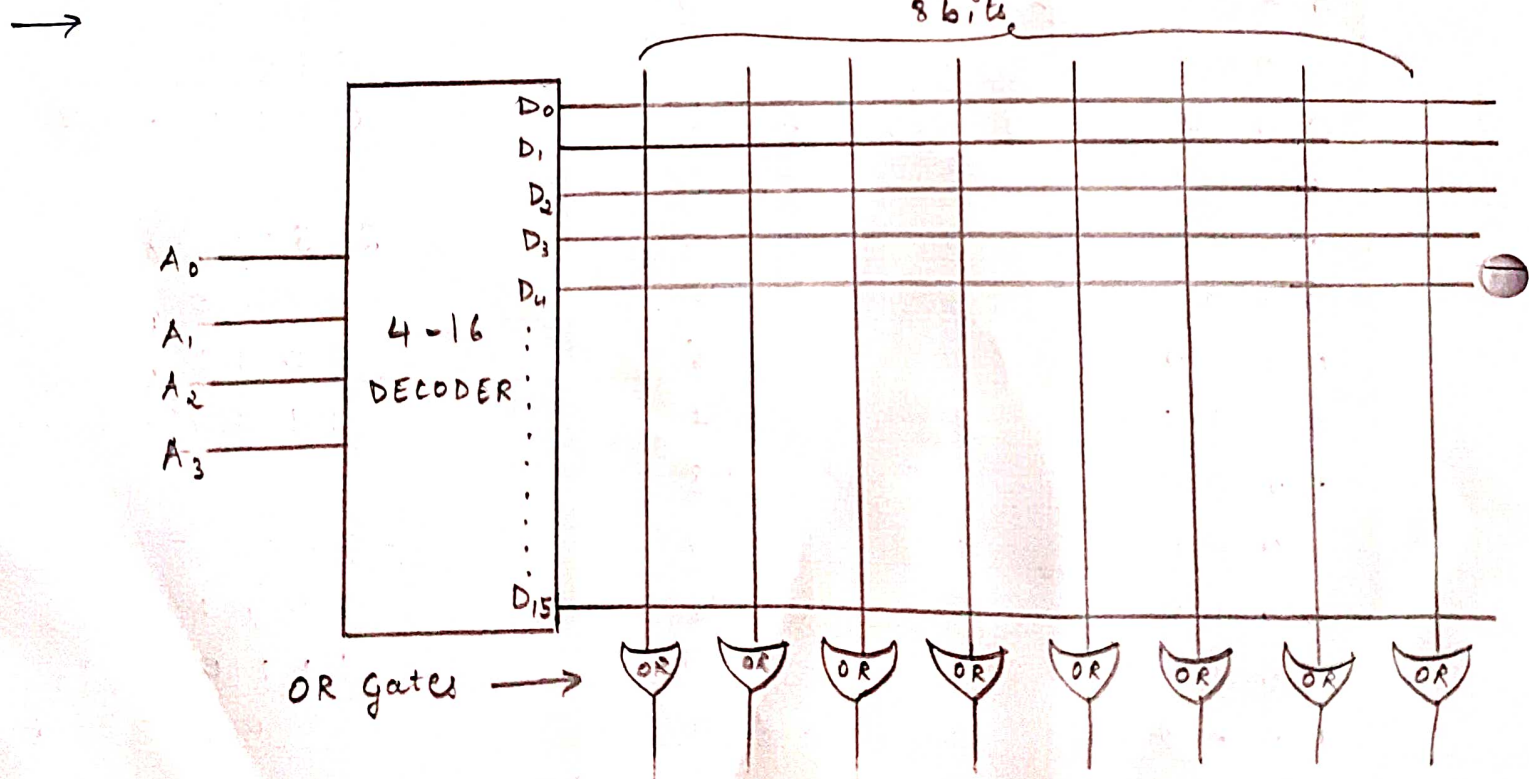
$2 + 5$, $2 - 5$, $-5 - 2$

| | | | | |
|---|------|----------|--------|-------------------------|
| → | bits | unsigned | signed | $2 + 5 = 7$ |
| | 0000 | 0 | 0 | 0010 |
| | 0001 | 1 | 1 | 0101 |
| | 0010 | 2 | 2 | 0111 $\Rightarrow 7$ |
| | 0011 | 3 | 3 | |
| | 0100 | 4 | 4 | $2 - 5 = (-3)$ |
| | 0101 | 5 | 5 | 0010 |
| | 0110 | 6 | 6 | 1011 |
| | 0111 | 7 | 7 | 1101 $\Rightarrow (-3)$ |
| | 1000 | 8 | -8 | |
| | 1001 | 9 | -7 | $-5 - 2 = (-7)$ |
| | 1010 | 10 | -6 | 1011 |
| | 1011 | 11 | -5 | 1110 |
| | 1100 | 12 | -4 | 1001 $\Rightarrow (-7)$ |
| | 1101 | 13 | -3 | |
| | 1110 | 14 | -2 | |
| | 1111 | 15 | -1 | |

2. For C programming language, give the width (no. of bits) and integer range for these data types:

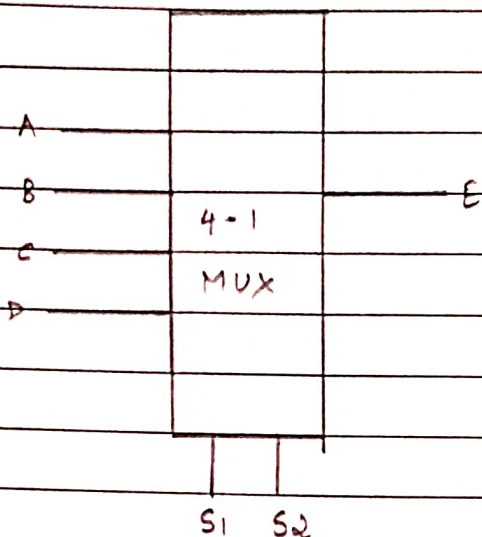
| Type | Width | Integer range |
|----------------|---------|---------------------------------|
| char | 8 bits | -128 to 127 |
| unsigned char | 8 bits | 0 to 255 |
| signed char | 8 bits | -128 to 127 |
| int | 16 bits | -32,768 to 32,767 |
| unsigned int | 16 bits | 0 to 65,535 |
| short | 16 bits | -32,768 to 32,767 |
| unsigned short | 16 bits | 0 to 65,535 |
| long | 32 bits | -2,147,483,648 to 2,147,483,647 |
| unsigned long | 32 bits | 0 to 4,294,967,295 |

3. Follow the ROM example in lecture, draw a ROM circuit with 4 bit address and 8 bit width.



4 bit address = 2^4 locations in memory.

4. Following is a 4-1 multiplexor with 4 input and 2 selector.



a. Create a truth table for this 4-2 multiplexor.

→

| S_1 | S_2 | A | B | C | D |
|-------|-------|---|---|---|---|
| 0 | 0 | I | 0 | 0 | 0 |
| 0 | 1 | 0 | I | 0 | 0 |
| 1 | 0 | 0 | 0 | I | 0 |
| 1 | 1 | 0 | 0 | 0 | I |

b. Write the formal form of logic formula for this truth table.

→ $Y = \bar{S}_1 \bar{S}_2 A + \bar{S}_1 S_2 B + S_1 \bar{S}_2 C + S_1 S_2 D$

c. Implement the 4-1 multiplexor from this formula
(draw circuit diagram)

