Homework 01: Binary Integer Number Formats

For the three types of representations:

(SB) straight binary,

(OB) offset binary, and

(TC) two’s complement …

1. Express the bit mapping and limitations on the range of values for converting between the three representations assuming size N.

Bits (N-1 downto 0)

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| N-1 | N-2 | N-3 | ∙∙∙ | 2 | 1 | 0 |

MSB LSB

(SB) → (OB) (SB) → (TC)

(OB) → (SB) (OB) → (TC)

(TC) → (SB) (TC) → (OB)

Example: (SB) → (OB)

Conversion: SB bit N-1 goes from 0 to 1.

Limitation: Range of values is 0 to 2(N-2)-1.

**Do the remaining 5 conversions.**

1. Increase the Width from N to M bits (M > N) for SB, OB, and TC.

Example: (SB)

Conversion: SB bits (N-1 downto 0) are directly copied and (M-N) zeros are concatenated to the beginning of the array.

**Do the remaining 2 representations.**

1. Express how addition would be handled and limitation on the range of values for addition of the three representations assuming size N.

Example: (SB), C = A + B

Addition: Normal addition using XOR gates and carry logic.

Limitation: The sum cannot exceed 2(N-1)-1.

**Do the remaining 2 representations.**

1. Express how addition would be handled and limitation on the range of values for addition of the three representations assuming size N.

Example: (SB), C = A - B

Addition: Invert all bits of B. Add A + B + 1.

Limitation: The difference cannot be negative.

**Do the remaining 2 representations.**