1

Convert the following unsigned numbers

$3527_8 = ?_2 = ?_{16}$
$10101001_2 = ?_{10}$
$101011011111001_2 = ?_{16}$
$105_{10} = ?_2$
$412_{10} = ?_8$
$101000.01_2 = ?_{10}$

✓ **Answer**

$3527_8 = 011|101|010|111_2 = 011101010111_2 = 0111|0101|0111_2 = 757_{16}$
$10101001_2 = 1 + 8 + 32 + 128_{10} = 169_{10}$
$101011011111001_2 = 0010|1011|0111|1001_2 = 2B79_{16}$
$105_{10} = 64 + 32 + 8 + 1_{10} = 1101001_2$
$412_{10} = 256 + 128 + 16 + 8 + 4_{10} = 110|011|100_2 = 634_8$
$101000.01_2 = 0.25 + 8 + 32_{10} = 40.25_{10}$

2

Indicate whether there is an overflow for the following operations where all the numbers are in two's complement form

$10010100 + 10010101$
$01000011 + 10010001$

✓ **Answer**

$10010100 + 10010101 = 100101001$
Yes, since both of the leading digits are high, this leads the output to be too large to store in 8 bits, making it overflow to 9. Truncating it to 8 bits will make it have an inaccurate answer.

$01000011 + 10010001 = 11010100$

No, since only one leading digit is high and there is no carry over from the previous bit, there is no overflow.

3

Perform the following operations by first representing the decimal numbers in two's complement number system. (Hint: the subtraction will become addition). Use 6 bits to represent the numbers.

$14 - 15 = ?$
$12 - 10 = ?$
$24 - 6 = ?$
$8 - 22 = ?$

✓ **Answer**

$14 - 15 = (8 + 4 + 2) - (8 + 4 + 2 + 1)$
$= 001110_2 - 001111_2 = 001110_2 + 110001_2 = 111111_2$

$12 - 10 = (8 + 4) - (8 + 2)$
$= 001100_2 - 001010_2 = 001100_2 + 110110_2 = 000010_2$

$24 - 6 = (16 + 8) - (4 + 2)$
$= 011000_2 - 000110_2 = 011000_2 + 111010_2 = 010010_2$

$8 - 22 = (8) - (16 + 4 + 2)$
$= 001000_2 - 010110_2 = 001000_2 + 101010_2 = 110010_2$

4

Complete the following table so that each row is the same number in four different representations.
For binary numbers, use six bits.

Decimal	Signed Magnitude	Two's Complement	One's Complement
-14			
	110110		

Decimal	Signed Magnitude	Two's Complement	One's Complement
		010011	
			110111

✓ Answer

Decimal	Signed Magnitude	Two's Complement	One's Complement
-14	101110	110010	110001
-22	110110	101010	101001
19	010011	010011	010011
-8	101000	111000	110111

5

Add the following unsigned numbers:

$9B4C_{16} + 12E3_{16} = ?$
$234_8 + 436_8 = ?$

✓ Answer

$9B4C_{16} + 12E3_{16} = AD2F_{16} + 0100_{16} = AE2F_{16}$
$234_8 + 436_8 = 662_8 + 010_8 = 672_8$