

Tutorial 1 – Number Representation **SOLUTIONS**

1. Convert the following numbers:

GIVEN		CONVERT TO	
Decimal	77	Binary, 8-bit signed	0100 1101
Decimal	-100	Binary, 8-bit signed	1001 1100
Decimal	99	Hex, 8-bit signed	63
Decimal	-5	Hex, 8-bit signed	FB
Decimal	-23	Hex, 8-bit signed	E9
Binary, signed	1101 1100	Hex, 8-bit signed	DC
Binary, signed	1101 1100	Decimal	-36
Decimal	81	Octal, 12-bit, unsigned	121
Octal, unsigned	777	Decimal	511
Hex, unsigned	FA	Octal, 9-bit, unsigned	372
Binary fixed pt.	11.0101	Decimal	3.3125
Decimal	0.85	Binary fixed pt. (4 deci.)	0.11011...
Decimal FP	-16.25	IEEE FP	1 1000 0011 0000 010...
IEEE FP	0 0111 1111 1110000 00000000 00000000	Decimal FP	+, exp=0; $1.111_2 = +1.875$
IEEE FP	1 1000 0010 0110000 00000000 00000000	Decimal FP	-, exp=3; $1.011_2 = -11$

2. Negate the following 8-bit numbers using 2's complement:

1011 1100 **0100 0011 → 0100 0100**

1000 0000 **0111 1111 → 1000 0000 (not possible to negate -128 !)**

3. Transform 8-bit 2's complement numbers into 16-bit 2's complement representation.

Given	Pos. Binary (8)	Neg. Binary (16)	Neg. Hex (16)
\$3A	0011 1010	1111 1111 1100 0110	FFC6
\$BB	1011 1011	1111 1111 0100 0101	FF45

4. Convert the following FP numbers to IEEE FP format (only up to 4 binary FP digits):

Given	Sign, Exponent	FP Bit sequence
0	sign=0, exp= -127 +127	0 0000 0000 0000 0000 0000 0000 0000 000
-1	sign=1, exp= 0 +127	1 0111 1111 0000 0000 0000 0000 0000 000
+1.1	sign=0, exp= 0 +127	0 0111 1111 0001 ...
-65.75	sign=1, exp= 6 +127	1 1000 0101 0000 0111 0000 ...
33.44	sign=0, exp= 5 +127	0 1000 0100 0000 1011 ...
1'000'000	sign=0, exp= 19 +127	0 1001 0010 1110 ...
1'048'576	sign=0, exp= 20 +127	0 1001 0011 0000 0000 0000 0000 0000 000