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Binary Conversions and Operations

Task 1 - Number Conversion

1) convert 1011 to decimal

$8\ 4\ 2\ 1$
$1\ 0\ 1\ 1 = 1+2+8 = \boxed{11}$

2) convert 11010101 to decimal

$128\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
$1\ 1\ 0\ 1\ 0\ 1\ 0\ 1 \rightarrow 128+64+16+4+1 = \boxed{213}$

3) convert 19 to binary

19	00000
19 - 16 = 3	10000
3 - 2 = 1	10010
1	10011

4) convert 45 to binary

	32 16 8 4 2 1
45 - 32 = 13	000000
13 - 8 = 5	100000
5 - 4 = 1	101000
1 = 1	101100
	101101

5) convert 45 to hexidecimal

$45 = (16\times 2)(1\times 13)$ $\quad 16\ 1$ $\quad 2\ 13$

$45 - 32 = 13 \rightarrow \boxed{2D} \rightarrow \boxed{0x2D}$

6) convert F to binary

$1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9\ 10\ 11\ 12\ 13\ 14\ 15 \rightarrow F = \boxed{15} \rightarrow \boxed{1111}$

$1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9\ A\ B\ C\ D\ E\ F$

7) convert 11010111 to hexadecimal

$128\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
$1\ 1\ 0\ 1\ 0\ 1\ 1\ 1 \rightarrow 1+2+4+16+64+128 = 215$

$215 = (\quad)(16\times 13)(1\times 7) \rightarrow \boxed{D7} \rightarrow \boxed{0xD7}$

$215 - 208 = 7$

8) convert hex # 46 to decimal

$16\ 1$
$4\ 6 \rightarrow (16\times 4)+(1\times 6) = 64+6 = \boxed{70}$

9) convert B2 to decimal

$B2 \rightarrow (16\times 11)+(1\times 2) = 176+2 = \boxed{178}$

10) convert 111001 to decimal

$32\ 16\ 8\ 4\ 2\ 1$
$1\ 1\ 1\ 0\ 0\ 1 = 1+8+16+32 = \boxed{57}$

Task 2 - Binary Operations

1) add 1101 + 0011

```
 1101
 0011 +
10000   → 0000
```

2) add 1000 + 0111 →

```
 1000
 0111 +
 1111
```

3) add 1111 + 1111 →

```
 1111
 1111 +
11110   → 1110
```

4) add 11101101 + 00111100 →

```
 11101101
 00111100 +
100101001   → 00101001
```

5) Subtract 1111 - 0011 →

Twos complement: 0011
(ones): 1100
(add one): 1101

```
 1101 +
11100   → 1100
```

6) Subtract 0011 - 1111 →

Twos complement: 1111
ones: 0000
add: 0001

```
 0001 +
 0100   → 0100
```

7) Subtract 1011 - 0101 →

Twos compliment: 0101
1010
1011

```
 1011 -
 0110   → 0110
```

8) Subtract: 0100 - 1000 →

```
 0100
 1000
 1100
```

```
1000
0111
1000
```

9) twos complement of 10110111

ones compliment: 01001000
add one: 01001001

10) twos complement of 11001011

ones: 00110100
add one: 00110101