Student's Name: _____

1. How many items can be counted using 3 bits?

(2 points)

Answer:

8 items   as $2^3 = 8$

2. Consider a number $(312)_7$ is base 7.
   Convert it to base 10.

(2 points)

$$(312)_7 = 3 \times 7^2 + 1 \times 7^1 + 2 \times 7^0$$
$$= 3 \times 49 + 1 \times 7 + 2 \times 1$$
$$= 147 + 7 + 2$$
$$= 147 + 9 = 156$$

3. Consider a binary number $(1011\ 1000)_2$ to decimal.

(2 points)

$$(1011\ 1000)_2 = 0 \times 2^0 + 0 \times 2^1 + 0 \times 2^2 + 1 \times 2^3$$
$$+ 1 \times 2^4 + 1 \times 2^5 + 0 \times 2^6 + 1 \times 2^7$$
$$= 0 + 0 + 0 + 8 + 16 + 32 + 0 + 128$$
$$= 184$$

4. Consider a decimal number 200. Write its binary equivalent (or base 2 equivalent).

(2 points)

2	200	
2	100	0
2	50	0
2	25	0
2	12	1
2	6	0
2	3	0
	1	1

11001000

5. Binary Addition: (2 points)

$$
\begin{array}{r}
1\ 1\ 1\ 1\ 1\ 1\ 1\ 1 \\
0\ 0\ 1\ 1\ 0\ 1\ 1\ 1 \\
0\ 1\ 0\ 1\ 1\ 0\ 1\ 1 \\
\hline
1\ 0\ 0\ 1\ 0\ 0\ 1\ 0
\end{array}
$$

6. Convert the following hexadecimal numbers to decimal.

AOB

(2 points)

$A = 10$
$B = 11$

$B \times 16^0 + 0 \times 16^1 + A \times 16^2$

$11 \times 1 + 0 + 10 \times 256$

$11 + 2560$

$= 2571$

$$
\begin{array}{r}
2560 \\
11 \\
\hline
2571
\end{array}
$$

⑦ In a sign-magnitude notation, a binary number is written as $(11100)_2$. What is its decimal equivalent with sign?

(2 points)

1 is the MSB so, it is a negative number.

for the remaining bits 1100_8

In decimal, $0 \times 2^0 + 0 \times 2^1 + 1 \times 2^2 + 1 \times 2^3$

$= 0 + 0 + 4 + 8$

$= 12$

Hence

$(11100)_2 = -12$

⑧ Two's Complement: Convert -50 to 2's complement representation using 8 bits.

(4 points)

50 in binary:

```
2 | 50
2 | 25 | 0
2 | 12 | 1
2 | 6  | 0
2 | 3  | 0
  | 1  | 1
```

$(00\,11\,00\,10)_2$

$= (50)_{10}$

Flip 0 to 1 and 1 to 0:   11001101

$$1100\ 1101$$
$$+\ 1$$
$$\overline{1100\ 1110}$$

⑨ Is 0111 0111 und 2's complement scheme
   a negative number or a positive number?

   A positive number.