

**Problem 1.** Which can you count higher on?

- a. 5 fingers, each of which can be held "up" and "down"?
- b. 4 fingers, each of which has an "up", "down", and "middle" position?

a:  $2^5 = 32$  max count

b:  $3^4 = 81$  max count

**Problem 2.** Suppose you have a binary storage device that can count to 16.

1. How many bits does it have?

Hint: how many fingers do you need to count to 16, if each one is either up or down?

2. Suppose you discover that each bit can actually have 3 positions. How high can you count now?

81

3. After more work, you discover that each bit can have 10 positions. How high can you count?

10000

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**Problem 3.** Write each of the following in base-2, base-8, base-10, and base-16 (use the subscript to indicate what base you are using). For example:

$$10_{10} = 1010_2 = 12_8 = 10_{10} = A_{16}$$

(a)  $11_{10}$

$$11_{10} = 1011_2 = 13_8 = B_{16}$$

(b)  $100110_2 = 38_{10} = 46_8 = 26_{16}$

(c)  $FF_{16} = 255_{10} = 377_8 = 1111,1111_2$

Hint: what is  $FF + 1$  in base-16?  
That makes this easier.

**Problem 4.** Taken off.

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**Problem 5.** Simplify, in base-16:

$$(a) 9FC + 4 = A00$$

$$(b) 2143 * 4 = 850E$$

$$\text{Note: } 3 * 4 = E$$

$$(c) 100 - 2 = FE$$

**Problem 6.** Simplify, in base-8:

$$(a) 3 * (7 + 2) = 33$$

$$(b) 7 * 6 = 52$$

$$(c) -362 + 3126 = 2544$$

**Problem 7.** The basic standard way to encode letters is the ASCII format. The chart below tells you how each letter is represented, in base-16:

ASCII Chart																
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2	SP	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL

For example, the letter A is represented by  $41_{16} = 65_{10}$ , while the letter a is represented by  $61_{16} = 97_{10}$ . The first two rows are special characters, mostly not in use. "SP" means the space character " ".

(a) Write the following ASCII message using the correct letters:

48 45 4C 4C 4F 20 57 4F 52 4C 44 21

HELLO WORLD!

(b) Write the following in ASCII code:

"Hello world!"

Hint: not the same as (a). Look @ lowercase letters.

(c) Taken off.