Appendix A
Different Bases

Writing numbers in different bases can be readily understood by examining how numbers in base 10 are written. Consider the number 1,251. This means: 1 one-thousand, 2 one-hundreds, 5 tens, and 1 one.

With the concept of place-value we can construct a table showing the placement for each of these numbers.

Decimal Table

Thousands	**Hundreds**	**Tens**	**ones**
10x10x10	10x10	10	1
10^3	10^2	10^1	10^0
1	**2**	**5**	**1**

Notice that each column above can be written as increasing multiples of ten (powers of ten)—see Chapter Five, page 82. The same pattern can be used to express any number in any base. To write the number 1,251 in base 2 we form columns of numbers with increasing powers of 2.

Binary Table

2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0	0	1	1	1	0	0	0	1	1

Therefore the binary number for 1,251 is 10011100011. (The term binary is used for base two.) This is what's happening: There is one 2^{10}(1024) in 1,251. If we subtract 1,024 from 1,251 we have 227. But there is one 2^7(128) in 227. Subtracting 128 from 227 gives 99. There is one 2^6(64) in 99. Subtracting 64 from 99 gives 35. There is one 2^5(32) in 35. Subtracting 32 from 35 gives 3. There is one 2^1(2) in 3. Subtracting 2 from 3 gives 1, and there is one 1 in 2^0.

We do exactly the same thing in order to write a number in base ten. How many 10^3(1,000's) in 1,251? One. We subtract 1,000 from 1,251 which gives 251. How many 10^2(100's) in 251? Two. We subtract 200 from 251 which gives 51. How many 10^1(10's) in 51? Five. We subtract 50 from 51 which gives 1. How many 10^0(1) in 1? One.

Regardless of the base a number is expressed in, the same pattern is followed. For example, to express a number in base 3 we would construct a similar place-value system using powers of three. Verify for yourself that 1,251 in base 3 is 1201100.

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In Chapter 5, example 3, you were shown how to calculate percent profit. Actually, there is more than one definition used to calculate this value. The method shown in Chapter 5 was: (profit in dollars/cost to seller) $\times$ 100. Using this definition, it makes no sense to assume that the seller's cost was ever zero. If it were, you would be dividing by zero which would yield an undefined (infinite) percent profit. In a typical business transaction there would always be a cost to the seller. However, confusion may arise when, on a personal level, an item is obtained without cost (an inheritance, a gift, a lucky find, etc.) What then?

Here we have another definition available to us: (profit in dollars/selling price) $\times$ 100. Using this definition the denominator can never be zero, nor can the percent profit ever be greater than 100 percent.