Alternate Base Systems
for Cross-Curricular Fun & Engineering Applications

OVERVIEW OF WHAT BASES ARE: OCTAL

DESCRIPTION OF OCTAL BASE:

Octal, or base eight, uses the digits 0-8. It is primarily useful as a more compact encoding for binary. To count in Octal you would say: 1, 2, 3, 4, 5, 6, 7, 10 then 11, 12, 13, 14, 15, 16, 17, 20, etc. until, in decimal-base you get 64 (8 squared), which would be the "100" of the octal base.

HISTORY OF OCTAL BASE:

Octal has developed naturally as a counting system in certain cultures, particularly indigenous languages in Mexico and the American Southwest. It has been suggested as a base for daily human use by Charles XII of Sweden as well as by Hugh Jones, James Anderson, and Alfred B. Taylor of England. It is used now in computer science, primarily as a more compact coding for binary. Eight is two to the power of three, so three binary digits can be encoded as one octal.

E.g.: 101011010 (in binary)

101 = one four, zero twos, one one (in binary)	=	5	64's in octal
011 = zero fours, one two, one one (in binary)	=	3	8's in octal
010 = zero fours, one two, zero ones (in binary)	=	2	1's in octal

So binary "101011010" is more compactly encoded as octal "532." This scheme is used in standard Unix file permissions, often using octal directly.

USE OF THE OCTAL BASE:

Modern computers universally have a "word length" which is a power of two, and character encodings always work in eight or multiples of eight. This makes octal, or its bigger cousin hexadecimal, an ideal means for describing such things. A "byte," in computer science, is eight bits; this is why ASCII is limited to one hundred and twenty-seven characters, which is two to the power of seven (one character is used to indicate the number's sign). Unicode uses larger words to represent characters, but always does so in units of eight; so two-byte, or sixteen-bit, words form the subset of Unicode called UTF-8.

EXAMPLES:

Here is a number in base-10: 201. What does it mean? It means:
> two one-hundreds,
> zero tens, and
> one one.

What does this base-10 number, 201, equal in octal base? It is 311. What does it mean? It means
> three sixty-fours,
> one eight, and
> one one.

QUESTIONS:

1.) Can you think of any uses for octal other than the ones we discussed above?
2.) Is octal a convenient base for daily use? Why or why not?