MORE ABOUT NUMBER-NAMES

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This article continues my investigations of the logological properties of number-names begun in the February 1980 Word Ways with "Alphabetizing the Integers". Following the practice of Webster's Third New International Dictionary (see the table on page 1549), we consider number-names up to, but not including, one thousand vigintillion. Furthermore, we disregard all 'ands' and specify that no power of ten can stand alone without a modifier: e.g., ONE MILLION, but not MILLION. All calculations reported below have been made with a hand calculator, so it may be worth verifying and extending these results with the aid of a high-speed digital computer.

It appears quite certain that there is only one number-name written entirely with letters from one-half of the alphabet: TWO. There are only twelve number-names in which vowels (aeiouy) and consonants alternate: ONE, FIVE, SIX, SEVEN, NINE, TEN, ELEVEN, NINETY, NINETY-FIVE, NINETY-SIX, NINETY-SEVEN and NINETY-NINE. The longest of these is NINETY-SEVEN. When considering number-names beginning and ending with the same letter, the problem is more complicated. Clearly the smallest and shortest is NINETEEN. Of the many others, the alphabetically first is EIGHT BILLION EIGHTEEN MILLION EIGHTEEN THOUSAND EIGHT HUNDRED EIGHTY-FIVE, and the last is TWO VIGINTILLION TWO UNDECILLION TWO TRILLION TWO THOUSAND TWO HUNDRED TWENTY-EIGHT.

When written out, the longest number-name has 758 letters, and there are 3^{44} or about 10^{21} (one sextillion) such numbers. These numbers are generated by repeating the triplet x7y 22 times, where x and y take any of the values 3, 7 or 8. Of all these numbers, the first in alphabetical order is the number beginning EIGHT HUNDRED SEVENTY-EIGHT VIGINTILLION and repeating 21 more 878s. The last in alphabetical order repeats 373 twenty-two times. If the triad 777 is repeated 22 times, the unique number-name with the most syllables, 272, is produced.

As can be seen from the table of numbers in NI3, 23 or the 26 letters of the alphabet are used in number-names, lacking only the J, K and Z. Consider that the K sound is present in OCTILLION, leaving J and Z. Interesting, then, that the two non-precise dictionary-sanctioned (NI3) words for large numbers use just these two letters: JILLION and ZILLION. An example of a 56-letter number-name that uses all the 23 usable letters is FIVE SEPTENDECILLION SIX QUADRILLION EIGHT BILLION TWO MILLION. This 56-letter solution is not unique, but I have not found a shorter example. Remarkably, none of the 3^{44} possible longest number-names include all 23 letters. The longest number-name using all 23 letters must be two letters short of the maximum, or 756, since F and W cannot be included in any 758-letter solution.

It is clear that our number-names are built out of 49 linguistic units: the numbers 1 through 19 (19), the decade numbers from 20 to 90 (8), hundred (1), thousand (1) and the 20 -illion names. (Centillion, here, is neglected since it is not continuous with the others.) Many numbers can be written to include these 49 units just once each. One of the 4096 possible longest number-names using only units beginning with the same letter is SIXTY-SEVEN SEPTENDECILLION SEVENTY-SIX SEXDECILLION SEVENTY-SEVEN SEPTILLION SIXTY-SIX SEXTILLION SIXTY-SEVEN. The longest number-name I have found with linguistic units in alphabetical order is EIGHT HUNDRED NINE NOVEMDECILLION ONE QUINTILLION SEVENTY-SIX THOUSAND TWENTY-TWO (non-unique), with eleven units. Similarly, I could find no examples of more than eleven units for reverse alphabetical order: TWENTY-THREE SEXDECILLION SEVENTY-SEVEN QUADRILLION NINETY-NINE MILLION FORTY-FIVE (non-unique).

Because number-names consist of these linguistic units, it is easy to find sets of letters which form two or more different number-names (THREE HUNDRED FOUR, FOUR HUNDRED THREE). Further, it is easy to find sets of letters which can be rearranged to form two number-names in two different ways, with the numerical sum of these two number-names the same: e.g., FOURTEEN + SEVEN = SEVENTEEN + FOUR. What is surprising is that this can be done for the irregular number-names ONE + TWELVE = TWO + ELEVEN, a fact noted on page 233 of Language on Vacation (Scribner's, 1965). Can readers supply an earlier reference for this oddity?

When an odd number of number-names is alphabetized, a single number-name is in the center. In the group ONE through NINE, the center is ONE. Interestingly, for 1 through 19, it is also ONE, and for 1 through 99 it is still ONE. For 1 through 999, though, it becomes ONE HUNDRED NINETY-TWO, which is also the central number for 1 through 9999. One through 99,999 yields the central number 1092 and 1 through 999,999 yields (I think) 117,182.

Some of the problems of reverse alphabetization of the number-names are easier to solve than for alphabetical order. The alphabetically first (reverse) number-name is THREE HUNDRED and the alphabetically last is SIX HUNDRED SIXTY VIGINTILLION SIXTY SEPTILLION SIXTY SEXTILLION SIXTY. The first ordinal is SECOND and the last ordinal is SIX HUNDRED SIXTY VIGINTILLION SIXTY SEPTILLION SIXTY SEXTILLION SIXTY-FIRST.

There appears to be no number-name in English that has the same value (when letter-values A = 1, B = 2, etc. are summed) as the number it represents. Some near-misses include 219 (letter-total 218) and 253 (letter-total 254). At least in the first thousand or so number-names, the letter E is the most-used letter. It seems that as the -illion number-names are reached, I might overtake E in letter-frequency. If so, when does this occur?

Let us assume that all of the number-names have been inserted in an unabridged dictionary; which ones appear on their correctly-numbered pages? For NI2, there are three matches (822, 1702 and 2748), but for NI3 only two (1576 and 2475). In general, one can imagine inserting the first n number-names into <u>any</u> alphabetical list of n pages, and looking for the number of matches with page-numbers. Probability theory states that the expected number of such matches is one, but the actual matches that occur depend upon the detailed structure of the alphabetical list. To illustrate this, the editor supplied three lists: NI2 (words in the list spaced proportional to definition-length), the Air Force list of most NI2 words (no definitions), and the Morris County 1980 telephone directory (surnames spaced proportional to the number of bearers). Magically shrinking these lists to one to ten pages, one discovers the matches in the table below.

Pages	Morris TD	Air Force	NI2	Valid Range
1	ONE (.672)	ONE (.565)	ONE (.570)	0-1.0
2	TWO (.920)	TWO (.898)	TWO (.920)	.50-1.0
3	THREE (.902)	THREE (.867)	THREE (.881)	.67-1.0
6	SIX (.836)			.83-1.0
7	SIX (.836)	SIX (.782)	SIX (.787)	.71-.86
8	SEVEN (.820)	SEVEN (.770)	SEVEN (.768)	.75-.88
9		SEVEN (.770)	SEVEN (.768)	.67-.78
			FOUR (.334)	.33-.44
10	FOUR (.304)	FOUR (.314)	FOUR (.334)	.30-.40

For example, in the 500-page Morris TD the number TWO was inserted on page 460, at the .920 fractional position in the full list. In a two-page dictionary, the number TWO matches its page if its fractional position lies anywhere in the range of 0.5 to 1.0. Note that none of these lists creates matches when they are four or five pages in length.

What is the longest number-name ever written out, where the purpose had nothing to do with logology? What are the results for these logological problems if languages other than English are studied? In particular, are there solutions in other languages for a number-name whose letter-sum is equal to the number it represents?