(rated #1 googology website by Ask Jeeves/Teoma and Netscape and given 4 stars by ixquick.com)

See the links:

[googology wiki](http://googology.wikia.com/wiki/Googology)

[Pointless Large Number Stuff](https://sites.google.com/site/pointlesslargenumberstuff/googo-and-googolple-part-1)

[Why Isn't Googology A Recognized Field of Math](http://yudkowsky.tumblr.com/post/59156131876/why-isnt-googology-a-recognized-field-of-math)

[And How to Get High](https://www.amazon.com/How-High-Michael-Joaeph-Halm/dp/1719339945/ref=sr_1_1?keywords=how+to+get+high+halm&qid=1581388968&s=books&sr=1-1)

"Thy knowledge is become wonderful to me: it is high and I cannot reach it." (Psalm 138:6)

**GOOGOLOGY**

   In the beginning was the word and the word was "googol". That was the name given by nine-year-old Milton Sirotta, the nephew of mathematician Edward Kasner, about 1920 to the number represented by one followed by one hundred zeros. In John Horton Conway and Richard K. Guy's numbering system (a modified version of Nicolas Chuquet's) it was called ten duotrigintillion. In Pelletier's it was called ten sedecillion. In Donald Knuth's it was called one myriad undecyllion. In the Pelletier-Knuth system it would be called one million sextilliard. In the unambiguous compromise system using multiple millions it was the ridiculously awkward ten thousand million million million million million million million million million million million million million million million million million or ten thousand sixteen-millions. A neologism for this most neglected scientific activity, one of many founded by Archimedes. He had ironically reached the then "highest" [sic] number, our ten-to-the-eighty-quadrillionth (myriad-squared-to-the-myriad-squaredth-squared) about 200 BC!

   It can be represented mathematically and named in various ways as well, for example,

**hundred myriad-squared myriad-squared-trice** = 100(10,0002)(10,0004)

**ten-to-the-tenth-to-the-tenth** = (1010)10

**ten-to-the-hundredt**h = **hundredplex** = 10100

**to-the-second-ten-squared** = 2102

**twice-fifty-to-the-fiftieth** = (2(50))50

**hundred-to-the-fiftieth** = 10050

**el-zero-zero (base 100)** = L00100

**one-one-followed-by-hundred zeroes** = 110100

**twoduplex** = 10102

**oneplux** = g(3, g(2, g(2, g(3, g(3, g(2, g(2, g(3, g(2, 1 - 1, 10) - 3, 10), 2), 10), 10) - 3, 10), 2), 10)

André Joyce's came up with his own variant of Ackermann's Generalized Exponential to add to the plethora of other number systems.

g(0, a, b) = b + a (addition)

g(1, a, b) = ab = a\*b = a++b (multiplication)

g(2, a, b) = ba = a^b = a↑b = a\*\*b = a+++b (exponentiation)

g(3, a, b} = ab = a^^b = a↑↑b (tetration)

g(a, 0, 1) = 1 (zeroth power)

g(c, 0, a) = 1 (zeroth operation)

g(a, b, c) = g(a - 1, g(a -1 , b, c) , c) (expansion)

g(a, b, c, d) = g(a - 1, b, c, g(b, c, d)) (nesting about base number)

g(a, b, c, d, e) = g(a - 1, b, g(c, d, e), e) (nesting about power number)

g(a, b, c, d, e, f) = g(a - 1, b, c, g(d, e, f), e, f) (nesting about operation number)

g(2, g(2, g(2, 10, 10), 10) = g(2, 1, 2, 10, 10) =

g(2, 100, 10) = g(2, 50, g(1, 2, 50)) = g(2, 50, 100)

Soon after googol came the term "googolplex" for the antilogarithm of the googol, ten-to-the-googolth.

g(2, g(2, g(2, g(2, 10, 10), 10), 10) = g(3, 1, 2, 10, 10) =

g(2, g(2, 100, 10), 10) = g(2, 2, 100, 10) =

g(2, g(2, 50, g(1, 2, 50)), 10) = g(2, g(2, 50, 100), 10)

"Plexing" [from "plus exponent"] like this is a handy device for naming numbers both larger than a googol or a googolplex, from eleventyplex = g(2, g(1, 11, 10), 10) and far, far beyond.

  From the analogy "gross:great gross::googol:?", André Joyce concluded that the adjective "great" meant g(2, g(1, 3/2, 2), 12)), multiplying the exponent by 3/2 as making a gross, 144 = g(2, 2, 12) = 122 into a great gross, g(2, 3, 12) = 123 = 1,728; so that the first Arabian number (i. e., with 1001 digits, from *1001 Arabian Nights*) is the great googol = 101000 = g(2, 1000, 10) = g(2, g(2, g(1, 3/2, 2), 10)), 10) = g(2, 1, 2, g(1, 3/2, 2), 10) = g(2, g(2, 3, 10), 10) = g(2, 1, 2, 3, 10), and great googolplex is that number with the -plex suffix added:

(2, g(2, g(2, 3, 10), 10), 10) = g(3, 1, 2, 2, 10)

Then from another analogy this time from genealogy's great great grandfather = two-greats grandfather, he got to

**n-greats googol** g(2, g(2, g(2, 1, 1, 3/2, 2), 10), 10) = g(2, g(2, g(1, g(1, 3/2, 2), 2), 10), 10) = g(2, g(2, 5, 10), 10)

**n-greats googolplex** = g(2, n + 2, g(2, 100, g(3, 2, 10))).

He also defined the n-greats gross = g(n, 1, 2, g(1, 3/2, 2), 12), and since the Baker's gross = g(2, 2, 13) = 169, then the

**great Baker's gross** = g(2, g(1, 3/2, 2), 12) = g(2, 3, 13) = 2,197, the n-greats Baker's gross = g(n, 1, 2, g(1, 3/2, 2), 13), and since the

**Poulter's gross** = g(2, 2, 14) = 196, then the Poulter's great gross = g(2, 3, 14) = 2,744 and the

**n-greats Poulter's gross** = g(n, 1, 2, g(1, 3/2, 2), 14). The gross numbers beyond a googol start with 93-greats gross, 90-greats Baker’s gross, 88-great Poulter’s gross.

    Doug of the Googolplex Project (at [procrastinators.org](http://procrastinators.org/)) estimated printing out a googolplex would take another 3.125g(2, 85, 10) years to complete at the then current rate of 783,400 zeroes/sec. Frank Pilhofer recalculated taking into account the growth in printer speed and figured a mere 566 years. Paul Durish sped up the process considerably by not waiting for a faster technology but by changing to a more convenient base and got: googolplex = 10 in base googolplex in a few seconds.

  André Joyce took note that a googol could also be expressed as a function of its final Roman numeral, L, as twice-fifty-to-the fiftieth-power, and googolplex as a power of its final Roman numeral, X. That implied that the prefix googo- and the infix -ple- were actually operations on any Roman numeral, n, so that googon = g(2, n, 2n) (<https://oeis.org/A062971>) and nplen' = g(2, n', n). This was the foundation of vast family of googol-inspired number names (arithmonyms, Joyce called them), a more logical and laconic system of large number nomenclature, googologisms, now called googology (not to be confused, though it often is, with googlology, the art and science of googling or using the google.com search engine, which came much later in 1998.)

In 1900 Godfrey & Hilbury used the phrase "goo-goo eyes" and in 1901 H. McHugh used the phrase "googley-googley eyes". The related word "goggle" however goes back much further to "gogel" in the Wycliff Bible c.1380. In 1919 the comic strip "Barney Google" by Bill DeBeck started and by 1922 became introduction of Spark Plug the widely popular with the racehorse. In 1923 the songs "Barney Google (with the Goo-Goo-Googly Eyes)" and "Come On, Spark Plug!" by Bill Rose popularized both. Later in 1963 Charles M. "Sparky" Schulz popularized the googol further in his own comic strip.["Peanuts"](http://mgking.us/2012/03/milton-sirotta-gotta-hundred-zeros/).

Googologists fall into three categories. The first are the syntactic googologists who use creative wordplay to forge names and naming systems for large numbers, "covering all the bases" and "pausing to smell the roses". The second category are the abstract googologists who generate the largest numbers with the simplest, yet fastest-growing functions. The third category are the amateur googologists, whose numbers aren't very helpful contributions to either syntactic or abstract googology, whose definitions are inelegant, have no consistency or mathematical significance, and violate the Gentleman's Rule of large number duels,(["On Salad Numbers"](http://googology.wikia.com/wiki/User_blog:FB100Z/On_salad_numbers) by Nathan Ho), which do allow for numerical tricks, but require both logic and wit. (["Profs Duke It Out in Big Number Duel"](http://tech.mit.edu/V126/N64/64largenumber.html))

Any unusual notation must first be explained, primitive semantic vocabulary is not allowed and each counternumber be big enough so as to be unreachable in practice using only methods introduced earlier in the game. (["Big Number Duel"](http://web.mit.edu/arayo/www/bignums.html)) The notational system and number expressed in it is limited, sometimes to one standard chalkboard or even just a postcard (["The Largest Number Game"](http://www.heretical.com/pound/lnumg.html)).

The googol, an eye-goggling number, of course, has 200 factors. The smaller of the two prime power factors of googol, g(2, 100, 2), has been called a little googol, since it is one followed by a hundred zeroes in binary. Little bigger little googol is the term André Joyce used for the larger prime power factor of the googol, g(2, 100, 5), aka cyplev, from the vocalized Roman numeral C and the -plev suffix.

    Many other Roman numerals can therefore also be used as an operand, besides the original -x and -l such as: -i = 1, -ij = 2, -iv = 4, -v = 5, -vi = 6, -vij = 7, -ix = 9, -xi = 11, -xij = 12, -xiv = 14, -xvi = 16, -xvij = 17, -xix = 19, -xxi = 21, -xxij = 22, -xxiv = 24, etc. There could also be the less proper, but at least pronounceable, ones, like -il = 49, -ic = 99, -cic = 199, -cil = 149, -cid = 399, -dic = 499 = -dil, 901 = -mic, etc..

   Joyce multilingually also used the Mayan ox = 3 instead of the easily misunderstood Roman iii or iij to fill in the gaps: -ox = 3, -vox = 8, -xox = 13, -xvox = 18, or the more Mayan-like -xl from the Roman numeral XL for 40, formed many closely related Mayan-like suffixes without the explicitly verbalized L, -xoxl = 27, -oxl = 37 -jixl = 38, -ixl = 39, -xli = 41, -xlij = 42, -xlox = 43, -xliv = 44, -xlvy = 45, -xlvi = 46, -oxl = 47. [NOTE: Non-Mayan-speaking googologists have this ignored this usage and prefer to make III more pronounceable by representing central J and so as -iji and preserving the traditional Roman numerals as suffxes. It has been suggested that he was not so much avoiding the III as XIII, being a triskaidekaphobe. This hypothesis was countered with the fact that he was not afraid to live on the twelfth floor of his highrise. It is not known whether his offset was zero or one, whether he count from the ground floor starting from zero or from one, so this too remains one of the many mysteries of the mysterious André Joyce. For a collection of unusual number names he used in compounding more googolisms, which tend to prove that he was merely eccentric, see [arithmonyms](http://michaelhalm.tripod.com/arithmonyms.html).

    Thus names can be formed like:

[**googoc**](http://googology.wikia.com/wiki/Googoc) = g(2, 100, 200)  = g(2, 200, 20) = g(2, g(2, g(1, 10, 20), 20) > g(2, 230, 10)

[**googoci**](http://googology.wikia.com/wiki/Googoci) = g(2, 101, 202) > g(2, 232)

the Italian-like [**googocci**](http://googology.wikia.com/wiki/Googocci) = g(2, 201, 402) >g(2, 523, 10)

the adjective-like [**googoccic**](http://googology.wikia.com/wiki/Googoccic) = g(2, 299, 598)>g(2, 830, 10)

[**googom**](http://googology.wikia.com/wiki/Googom) = g(2, 1000, 2000)> g(2, 3300, 10)

    Many more Roman numerals can be made pronounceable using googology’s Principle of Equivalency which equates orthography and phonetics, V = "vy" (as in Ivy), X = "ex", L = "el", C = "cy" (as in Nancy), D = "dy" (as in Lady), M = "em" [or alternatively from telegraphers’ jargon, "ump", from which comes the numbers "umpteen" = 1010, and "umpty" = myriad = 10,000, NOTE: the -ex in -dex for 510 needed to be respelled with the silent -h- for "formerly high" , that is, -dhex when -dex was redefined by Sbiis Saibain as g(2, 100, g(3, n, 10)).]

[**googolex**](http://googology.wikia.com/wiki/Googolex) = g(2, 60, 120) > g(2, 125,10)

[**googoxem**](http://googology.wikia.com/wiki/Googoxem) = g(2, 990, 1980) > g(2, 3263, 10)

[**googomump**](http://googology.wikia.com/wiki/Googomump) = g(2, 2000, 4000) = g(2, 4000, 40) > g(2, 7204, 10)

     By googology’s Principle of Recursivity the gaps still left in the Roman numeral representations because of limitations of the Pronouncability Principle can be filled, still with classy Greco-Latin names. Numbers can be constructed by adding or subtracting repeating digital strings, [repdigits](https://oeis.org/A010785), multiples of Samuel Yates' [reunits](https://oeis.org/A002275) ["replicated units"] = R(n) = (g(2, n + 1, 10) - 1)/9) These are most easily represented by internal superscripts and hypermathematical addition by concatenation. They can however be expressed in an AGE expanded form asg(1, g(n - 1, 1, g(2, g(2, log(n) + 1, 10), n), n').Richard Rusczyk uses bent parentheses, **á**n, n'**ñ,** for representing his bigoogol = **á**googol, googol**ñ** g(1, g(2, 201, 10), g(2, 50, 100), and trigoogol = **á**googol, googool**ñ**, etc. ([A Googol Is A Tiny Dot"](http://www.artofproblemsolving.com/blog/24489).)

**quadrix** = four-nines = 929 = 9999 = 4**á**9**ñ** = g(2, 5, 10) - 1

**googolquadrix** = g(2, g(1. 2, 9999), 9999) = g( 2, 19998, 9999) > g(2, 43000, 10)

**vigintiv** = twenty-fours = 444444444444444444444 = 4184 = 4((g(2, 20 10) - 1)/9) = 20**á**4ñ

**quadrixvigintiv** = four-nines-twenty-fours = 999944444444444444444444 =

9(((g(2, 24 10) - 1)/9) - 5((g(2, 20 10) - 1)/9)

(NOTE: The Greek prefixes indicate an operation on all of the following expression, the Latin on just the next operand.]

**duquadrixvigintiv** = 999944444444444444444444999944444444444444444444 = 929 4184929 4184 = 2**áá**4**á**9**ñ**20**á**4ñññ = 9(((g(2, 48 10) - 1)/9) - 5((g(2, 44 10) - 1)/9) - 5((g(2, 20 10) - 1)/9)

**centix** = hundred-nines = 100**á**9**ñ =** 91009 = 10101 - 1)/9 <googol

**centxi** = hundred-elevens = 100**á**11**ñ =** 200**á**1**ñ =** (10201 - 1)/9 > googol

**bigoogol** = g(1, g(1, g(1, g(2, log(2, 50, 100), 10)), g(2, 50, 100)) = g(1, g(2, 201, 10), g(2, 100, 10)

Beyond hypermath addition is, of course, analogous higher generalized exponentials, such as multiplication, exponentiation, tetration, etc. They are however non-communicative. It is an essential feature of John Conway's [audio-active numbers](https://oeis.org/A005150). With Hydrogen identified with 223 = 5 and Oxygen, 1321122112133221123 = 1,514,363, then **H2O** would be 22221321122112133221123 = 31,288,508,915. "One" as a [chemonym](http://www.nandor.org/math/chemwords/wordslist.htm) would be **ONe**, Oxygen neonide, 1321122112133221121112133221123 = 156,705,898,997,471. "NiNe", TeN".

By extrapolating Mendeleev's Sanskrit prefixes Joyce coined audio-active element names to vivaharadon and nahutaradon.

   Another interesting set of related numbers, whose patterns persists in their multiples, could be named using the astronomical suffix, -ile, for 1/n with the Greek and Latin prefixes:

the sacred number of the Pythagoreans.

**megaseptile** = g[1. -1, 2, 6, 10)/7] = 142,857 (where square brackets, [ ], indicate the floor function or rounding down to previous integer, INT(n), the numbers googologists care about.)

**two megaseptile** = 285,714 = 2[g(2, 6, 10)/7]

**three megaseptile** = 571,428 = 3[g(2, 6, 10)/7]

Robert Ripley's persistent number, [g(1, -1, g(2, 18, 10)/19] = 52,631,578,947,368,421 = integral **exaundevigintile** = [exa, g(2, 18, 10) ,+ undevigint, 19, + -ile (divided by)]  and similar numbers based on all the higher primes, like

**dekapetaseptemdecile** = [g(2, 16, 10)/17] =  588,235,294,117,647

**dekazettatrevigintile** =[g(2, 22, 10)/23] = 434,782,608,695,652,173,913

**myriayottaundetrigintile** =[g(2, 28, 10)/29] = 344,827,586,206,896,551,724,137,931

**dekazettayottaseptemquadragintile** = [g(2, 46, 10)/47] = 212,765,957,446,808,510,638,297,872,340,425,531,914,893,617

   Noting that the representation for thousands above M in Roman numerals is with an added bar above the numeral, Joyce defined -bar as a multiplicative operator on the Roman numerals: nbar = 1000n

**googolbar** = g(2, 50000, 100000) = g(2, 25000, 10)

**googocbar** = g( 2, 100000, 20000) >g(2, 530103, 10)

**googodbar** = g(2, 500000, 1000000) = g(2, 3000000, 10)

**googombar** = g(2, 1000000, 2000000) > g(2, 6301029, 10)

**googomembar** = g(2, 2000000, 4000000) > g(2, 13204119, 10)

   Applying the -bar operator not only to the Roman numerals, but also to the Latin infixes and itself forms much abbreviated googologisms, if "barbaric" ones,

**umpbarbar** = g(1, 1000, g(2, 1000, 1000) = g(1, 1000, g(3, 2, 1000) = g(2, 3003, 10)

**umpbarbarbar** = g(1, 1000, g(2, g(2, 1000, 1000), 1000), 1000) = g(2, 3g(2, 3003, 10) + 3, 10)

   Multiple plexing has however became indicated less barbarically by other googologists with Greek infixes like -du- :

**googolduplex** =  g(2, g(2, g(2, g(2, 2, 10), 10), 10), 10) = g(4, 1, 2, 2, 10)

**googoltriplex** =  g(5, 1, 2, 2, 10), etc. [NOTE: The -triplex suffix is pronounced "try-pleks" NOT "triple-X"!]

    Joyce's barbarian numbers would therefore rather be named umpdubar, umptribar, etc.

Tom Kreitzberg contributed the extrapolation of the prefix gag- = g(n+1, n, 2) called mag- which in Joyce's notation is g(n, n + 1, n, 2), prompting Joyce in turn to extrapolate to ala -illions, to:

**baggoogol** = g(2, n, n + 1, n, 2) = g(n, g(n + 1, g(n + 1, n, 2), 2),

**traggoogol** = g(3, n, n + 1, n, 2) = g(2, n, g(n + 1, g(n + 1, g(n + 1, n, 2), 2), 2),

**quadraggoogol** = g(4, n, n + 1, n, 2) = g(3, n, g(n + 1, g(n + 1, g(n + 1, n, 2), 2), 2), etc.

Stephan Houban contributed the prefix fuga- (pronounced "few-gah") for g(2, n -1, g(2, n, n)) and megafuga- = g(3, 2, n) giving:

**fugagoogol** = g(2, g(2, g(2, 50, 100) - 1, g(2, 50, 100), g(2, 50, 100)) = g(2, 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

**megafugagoogol** = g(3, 2, g(2, 50, 100))

He estimated megafugafour = g(4, 2, 4) > g(2, 153, g(3, 2, 10)) and claimed "We can safely say that computing all the digits of megafugafour will never happen.",  to which Sunir Shah responded with "Never happen? Nonsense! Here they are: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. (Some assembly required.)" The same of course applies to nearly all larger numbers, since above the first pandigital number, 1,023,456,789, the probability of a number not having at least one of each digit approaches zero.

   Stephan Houban's megafuga- = g(4, 2, n), to get megafugagoogol = g(4, 2, g(2, 100, 10)).  Megafuga- does not use the prefix mega- as in the Greek-based SI (metric) prefixes, meaning g(2, 6, 10), a million, but in the original meaning of "arge"

Joyce quickly extrapolated again into a couple new branches of the googol family.

**begafugagoogol** = g(2, 1, 1, 3, 2, g(2, 50, 100))

**tregafugagoogol** = g(3, 1, 1, 5, 2, g(2, 50, 100))

**quadegafugagoogol** = g(4, 1, 1, 2, g(2, 50, 100)), etc. and

**gigafugagoogol** = g(g(2, 9, 10), 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

**terafugagoogol** = g(g(2, 12, 10), 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

**petafugagoogol** = g(g(2, 15, 10), 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

**exafugagoogol** = g(g(2, 18, 10), 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

**zettafugagoogol** = g(g(2, 21, 10), 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

**yottafugagoogol** = g(g(2, 24, 10), 1, g(2, g(2, 50, 100) - 1, g(2, 50, 100)))

   Since zetta- (z + (s)etta) for g(2, 21, 10) and yotta- (y + otto) for g(2, 24,10) obviously seem formed from the reverse alphabet (as Aronson and Blowers noticed) and Italian numbers (nove, dieci, undici, dodica, tredici, quattordici, quindici, sedici, diciasette, diciotto, diciannove, venti, etc.) Joyce extrapolated getting the potmanteaux: **xova-** [x + nove], g(2, 27, 10), **weica-** [w + dieci] g(2, 30, 10). To keep them the traditional bisyllabic he used the just the initial syllables:

**vunda-** [v + undici], g(2, 33,10), **uda-** [u + dodici], g(2, 36, 10), **treda-** [t + tredici], g(2, 39, 10), and **satta-** [s + quattordici],  g(2, 42,10), **rinda-** [r + quindici],  g(2,45, 10), **qeda-** [q + sedici], g(2, 48, 10), **pica-** [p + diciasette],  g(2, 51, 10), **oca-** [o + diciotto], g(2, 54, 10), **nica-** [r + diciannove], g(2, 57, 10), **menta-** [m + venti], g(2, 60, 10).

   Beyond menta- -(e)nta- is used until **sara-** [s + quaranta], g(2, 120, 10), -(a)ra- until **inqua**-  [i + cinquanta], g(2, 150, 10), -(i)nqua- until **yessa-** [y + sessanta], g(2, 180, 10), -(e)ssa- until **otta-** [o  + settanta], g(2, 210, 10), (e)tta- to **zetta-** [z + settanta] g(2, 255, 10). This is the limit of the system since the next prefix would be yotta- again. Similarly **xovi-** through **zetti-** would mean g(2, -27, 10)to g(2, -255, 10)..

[These prefixes, among many other proposed ones, however have not yet received universal acceptace by the googologist community.]

Neither has the IEC's use of binary approximations of the SI prefixes: **kibi-** = g(2, 30, 2) = 1024, **mebi-** = g(2, 20, 2) , **gebi-** = g(2, 30, 2), **tebi-** = g(2, 40, 2), **pebi-** = g(2, 50, 2), **exbi-** = g(2, 60, 2), **zebi-** = g( 2, 70, 2), **yobi-** = g(2, 80, 2), which can also be extended Joycesquely to **xobi-** = g( 2, 90, 2), **wiebi-** = g(2, 100, 2), a little googolth,**vubi-** = g(2, 110, 2), **ubi-** = g(2, 120, 2), **trebi-** = g(2, 130, 2), **sabi-** = g(2, 140, 2), **ribi-** = g(2, 150, 2), **qebi-** = g(2, 160, **pibi-** = g(2, 170, 2), **obi-** = g(2, 180, 2), **nibi-** = g(2, 190, 2). Interpreting other four-letter compound prefixes, like **meme-**, **mege**-, **mete-**. ..., **yoze**-, to **yoyo-** as Asimov did his teratera- operationally rather than multiplicatively would mean yoyo- = 2(1024) and Yoyodyne, the Red Lectroids' front organization in *Buckaroo Banzai Across the Eighth Dimension* by Earl MacRauch, would refer to a force greater than to-the-fourth-ten dynes.

**xoxogoogol** = g(2, 1, 1, 2, 90, (g(2, 50, 100)) = g(g(2, 90, (g(2, 50, 100)), 90, (g(2, 50, 100))

**ninigoogol** = g(2, 1, 1, 2, 190, (g(2, 50, 100)) = g(g(2, 190, (g(2, 50, 100)), 190, (g(2, 50, 100))

**myriaplexaggoogol**, = g(g(2, 1000, 10), 1, 1, g(2, 50, 100), g(2, 50, 100), g(2, 50, 100), g(2, 50, 100))

**megaplexaggoogol** =g(g(2, 10000000, 10), 1, 1, g(2, 50, 100), g(2, 50, 100), g(2, 50, 100), g(2, 50, 100)), etc.

Joyce also expanded the googol family further by noting that not only did the o-count indicate the operation number of the generalized exponential, but the vowel sounds, and if necessary the following semivowels, might indicate the digits of its English name.  Just as googol obviously had o = 1, oo = 2, so it implied that ee = 3, or = 4, ie = 5, hi = 6, e = 7, ei = 8, ein = 9. er = 0, so that er [o + er] = 10.

[Joyce originally wrote these sounds with the French diacritical markings, but inconsistently as he shifted from French to Franglish, writing û for 2, ï or sometimes î for 3, yet sometimes also for or 0, ë or ê or è for 8. The orthography was eventually standardized almost. Since gigol, with a lone i from six, conflicted with Jonathan Bowers's much higher gigol, fka gygol, g(6, 100, 10), Joyce changed it to gerigol, adding -er- for a preceeding zero. That eventually was changed again to the homonumous ghigol with the addition of a silent -h- infix instead.]

**googol** = g(2, 50, 100)((2(50))

**googool** = g(2, 100, 100) = g(2, 200, 10) = gargoogol [ Kieran Cook]

**geegol** = g(2, 50, g(1, 3, 50))

**gorgol** = g(2, 50, g(1, 4, 50))

**giegol** = g(2, 50, g(1, 5, 50))

**ghigol** = g(2, 50, g(1, 6, 50))

**gegol** = g(2, 50, g(1, 50, 7)) = g(2, 50, 350)

**geigol** = g(2, 50, g(1, 50, 8)) = g(2, 50, 400)

**gegol** = g(2, 50, g(1, 50, 9)) = g(2, 50, 450)

Like dozen or score have survived, so too have some infixes still resist the conversion to the decimal system, using the not quite so silent -h- infix to separate the digits: -en- for ten (rather than oer), -el- for eleven, -wel- for twelve, -ir- for thirteen, -un- from hundred, -ou- for thousand, -y- for myriad, -il- for million, -ril- for trillion, -ua- for quadrillion, -yl- for myllion, -in- for quintillion.

**gengol** = g(2, 50, g(1, 10, 50)) = g(2, 50, 500)

**gelgol** = g(2, 50, g(1, 11, 50)) = g(2, 50, 600)

**gwelgol** = g(2, 50, g(1, 12, 50)) = g(2, 50, 600)

**girgol** =g(2, 50, g(1, 13, 50)) = g(2, 50, 650)

**gogirl** = g(2, g(1, 13, 50), 50) = g(2, 650, 50)

Since gogon is g(2, n, n) = g(3, 2, n) and gogogogon is much more powerful. Joyce named the number level intermediate between them gogogon = g(n, 2, n, n), so that gogogogon could name g(n, n, 2, n, n). Substituting for the -o- infixes, he named numbers like:

**gogogirl** = g(g(1, 13, 50), 2, g(1, 13, 50), g(1, 13, 50)) = g(650, 2, 650, 650) = g(650, 3, 2, 650)

**gogogogirl** = g(g(, 1, 13, 50), g(1, 13, 50), 2, g(1, 13, 50), g(1, 13, 50)) = g(650, 650, 2, 650, 650) = g(650, 650, 3, 2, 650)

With the g-count, analogous to the o-count for vowels, operations can be easily upgraded. Noting that the two g's in googol represent the first and second operations, multiplication and addition, doubling the interior g's would logically increases each operation by one. By the Principle of Pronouncability this could not be applied to the initial g.

**googgol** = g(3, 50, g(2, 2, 50))

**googgool** = g(3, g(2, 2, 50), g(2, 2, 50)) = g(4, g(2, 50, 100))

**geeggeel** = g(3, g(2, 3, 50), g(2, 3, 50)) = g(4, g(2, 150, 100))

**geiggeil** = g(3, g(2, 8, 50), g(2, 8, 50)) = g(4, g(2, 400, 100))

**geiggeim** = g(3, g(2, 8, 1000), g(2, 8, 1000)) = g(4, g(2, 8, g(2, 2, 100))

**gungunmump** = g(4, g(2, 8, g(2, 2, g(1, 100, 2000))))

**gougoumump** = g(4, g(2, 8, g(2, 2, g(1, 1000, 2000))))

**gygymump** = g(4, g(2, 8, g(2, 2, g(1, 10000, 2000))))

**gilgilmump** = g(4, g(2, 8, g(2, 2, g(1, g(2, 6, 10), 2000))))

**gylgylmump** = g(4, g(2, 8, g(2, 2, g(1, g(2, 16, 10), 2000))))

Biggoogol however was defined at [**"A Googol Is A Tiny Point"**](http://www.artofproblemsolving.com/blog/24489) blog, as a hundred googols added concatenationally twice and symbolized as the two-argument <centagoogol, centagoogol>, where a **centagoogol** is googol added concatenationally googol times. in AGE it isg(2, 1, 100, g(2, g(2, g(1, 1, log(g(2, 50, 100))), 10), g(2, 50, 100)) ≈ g(2, 20200, 10). It is NOT Joyce's **biggoogol** with a -g- upgrade to g(2, g(2, g(2, g(3, log(3, 50, 100), 10)), g(3, 50, 100)) = g(2, g(2, g(2, g(3, g(3, 50, 100) -1, 10)), g(3, 50, 100)). Joyce added a silent -h- to the smaller biggoogol, and called it **bhiggoogol**.

The same blog page however also includes larger numbers, which while not following the Principle of Pronouncability do eventually reach the number gwgoogol, which, is pronouncable, at least in Welch where -w- is a vowel, pronounced "ow". Even nesting concatenations to to-the-hundredth-hundred however is not anywhere near as powerful as an upgrade from 2 (multiplication) to 2 (tetration).

**gwgoogol** = g(g(3, 2, g(2, g(2, 50, g(2, 50, g(1, 2, 50))), 1, g(1, 2, 50), g(2, g(2, g(1, 1, log(g(2, 50, 100))), 10), g(2, 50, 100))

Joyce did however add the gw- to his prefix arsenal, for powers of ten, filling in some gaps.

**gwnplex** = g(g(3, 2, g(2, g(2, n, n), 1, g(1, 2, n), g(2, g(2, g(1, 1, n), 10), n)

**gwnplec** = g(g(3, 2, g(2, g(2, n, n), 1, g(1, 2, n), g(2, g(2, g(1, 1, n), 100), n)

**gwmplem** = g(g(3, 2, g(2, g(2, 1000, 1000), 1, g(1, 2, 1000), g(2, g(2, g(1, 1, 1000), 1000), 1000)

With the second interior -g-, we can upgrade by counting the g's binarily, so that the positioning of the double-g's as well as their number counts:

**goggirl** = g(3, g(3, 13, 50), 50)

**gogoggirl** = g(g(2, 13, 50), 2, g(2, 13, 50), g(2, 13, 50)) (g + gg = 012)

**goggogirl** = g(g(3, 13, 50), 2, g(3, 13, 50), g(3, 13, 50)) (gg + g = 102)

**goggoggirl** = g(g(4, 13, 50), 2, g(4, 13, 50), g(4, 13, 50)) (gg + gg = 112)

**goggogogirl** = g(g(3, 13, 50), 2, g(3, 13, 50), g(3, 13, 50)) (gg + g + g = 1002)

**goggogoggirl** = g(g(4, 13, 50), 2, g(4, 13, 50), g(4, 13, 50)) (gg + g + gg = 1012)

**goggoggogirl** = g(g(5, 13, 50), 2, g(5, 13, 50), g(5, 13, 50)) (gg + gg + g = 1102)

**goggoggoggirl** = g(g(6, 13, 50), 2, g(6, 13, 50), g(6, 13, 50)) (gg + gg + gg = 1112)

At a g-count of four the Law of Pronouncability went into effect and used the one-argument go- prefix for the higher one-argument Ackermann function, A(n, n) = g(n + 1, n, n).

**gol** = g(51, 50, 50) = g(52, 2, 50)

**gomump** = g(2001, 2000, 2000) = g(2002, 2, 2000)

**goul** = g(50001, 50000, 50000) = g(50002, 2, 50000)

**goumump** = g(2000001, 2000000, 2000000) = g(2000002, 2, 2000000)

[NOTE: gargoyl seems to have been a mispronunciation or gargirl = g(2, 2, g(g(1, 13, 50) + 1, g(1, 13, 50), g(g1, 13, 50)) = g(2, 2, g(651, 650, 650))]

Another handy infix used on this blog was -pr- for "1st prime after" substituted for the right-most -g-, giving:

**gooprol** = g(1, 267, g(2, 50, 100)) > googol = g(2, 50, 100)

In combination with the Latin prefixes substituted for the next -g- to the left, more distant primes can be named.

**booprol** = g(1, 949, g(2, 50, 100))>gooprol

**trooprol** = g(1, 1243, g(2, 50, 100))> booprol

**quadrooprol** = g(1, 1293, g(2, 50, 100)) > trooprol

(See[primes above a googol](https://oeis.org/A049014)**)**

**gooprovi** = g(1, 7, g(2, 6, 12)) > googovi = g(2, 6, 12)

**booprovi** = g(1, 19, g(2, 6, 12)) > gooprovi

**trooprovi** = g(1, 37, g(2, 6, 12)) > booprovi

**quadrooprovi** = g(1, 43, g(2, 6, 12)) > trooprovi, with which it makes a sexy odd couple

**quintooprovi** = g(1, 69, g(2, 6, 12) > quadrooprovi

**gooprovij** = g(1, 9, g(2, 7, 14)) > googovij = g(2, 7, 14)

**booprovij** = g(1, 37, g(2, 7, 14)) > gooprovij

**trooprovij** = g(1, 87, g(2, 7, 14)) > booprovij

**quadrooprovij** = g(1, 89, g(2, 7, 14)) > trooprovij

**quintooprovij** = g(1, 99, g(2, 7, 14)) > quadrooprovij

Jonathan Bowers came up with yet other rather larger googolisms independently of either Kreitzberg or Joyce, as is typical in the history of googology:

**gaggol** = g(4, 100, 10)

**boogol** = g(101, 100, 10)

Extrapolating again from the -illions, Joyce got:

**troogol** = g(101, g(1, 3, 10), 10),

**quadroogol** = g(101, g(2, 4, 10), 10), etc.

Applying Bowers suffix -plux, from golapulusplux to googol Joyce got in his MGE notation:

**googolplux** = g(g(3, 2, g(2, 50, 100)), 1, 1, 2, 50, 100) = g(g(3, 2, g(2, 50, 100)) -1, 1, 1, g(2, 50, 100), 50, 100)

Which he extrapolated to:

**googolpluc** = g(g(g(2, 2, 3), 2, g(2, 50, 100)), 1, 1, 2, 50, 100) = g(g(g(2, 2, 3), 2, g(2, 50, 100)) - 1, 1, 1, g(2, 50, 100), 50, 100)

**googolplum** = g(g(g(3, 3, 3), 2, g(2, 50, 100)), 1, 1, 2, 50, 100), etc.

After taking bazillion to be the indeterminate number g(z, 9, 10), Joyce also got high substituting specific Roman numeral values for the operational variable z to form a whole family of gazoogol numbers, so that gavoogol = g(5, 50, 100), gaxoogol = g(10, 50, 100),

**gamoogol** = g(1000, 50, 100)

**gammoogol** = g(2000, 50, 100)

**gammacoogol** = gammagoogolplex = g(2000, g(2, 2, 50, 100), 50, 100)

**maggoogol** = g(g(2, 50, 100), g(2, 50, 100) + 1, g(2, 50, 100), 2)

**gammamammazoogol** = g(2000, g(2, 2, 50, 100), 2000, g(2, 2, 50, 100), 50, 100)

**deltagoogolplex** = g(1, 2, g(2, 4, 10), g(2, 2, 50, 100), 50, 100) = g(20000, g(2, 2, 50, 100), 50, 100)

through isopsephia to

**omegagoogolplex** = g(1, 2, g(2, 800, 10), g(2, 2, 50, 100), 50, 100), etc.

With some roman numerals the -a- became became lost over time

gaivoogol = g'ivoogol = **givoogol** = g(4, 50, 100)

galoogol = g'loogol = **gloogol** = g(50, 50, 100)

gaimmoogol = g'immoogol = **gimmoogol** = g(200, 50, 100)

Continuing to use Roman numeral suffixes and infixes and even -az- also as prefixes, Joyce reaches magic numbers and magical numbers:

**magic** = g(99, 100, 99, 2) into magic- = g(99, 100, 99, 2, n)

**magicgoogol** = g(99, 100, 99, 50, g(2, 50, 100))

**magical-** = g(99, 100, 99, 50, n)

**magicalgoogol =** g(99, 100, 99, 50, g(2, 50, 100))

**bagicgoogol** = g(2(99), 2(99) + 1, 2(99), 50, g(2, 50, 100)) = g(198, 199, 198, 50, g(2, 100, 10))

**tragicgoogol** = g(3(99), 3(99) + 1, 3(99), 2, 50, 100) = g(297, 298, 297, 50, g(2, 100, 10)), etc.

Adding the extended SI prefix anti- = g(2, -96, 10) gives antitragic- and so:

**comicgoogol** = g(2, g( 2, -96, 10), g(297, 298, 297, 50, g(2, 100, 10)),

Especially interesting numbers sometimes became even more abbreviated by re-using Roman numeral prefixes:

**dccomicgoogol** = g(600, 1, 1, g( 2, -98, 10), g(297, 298, 297, 50, g(2, 100, 10)),

antimagicalgoogol = g(2, g( 2, -96, 10), g(99, 100, 99, 50, g(2, 50, 100))) = **mugglegoogol** [from J. K. Rowlings' Harry Potter's series' "muggle"]

**bugglegoogol** = g(2, 1, 1, 2, g( 2, -96, 10), g(99, 100, 99, 50, g(2, 50, 100)))

**trugglegoogol** = g(3, 1, 1, 2, g( 2, -96, 10), g(99, 100, 99, 50, g(2, 50, 100)))

These indices, of JMGE of course, can be easily modified and greatly abbreviated to name ever higher numbers using other googological nomenclature and mnemonics, in an ever increasing number of combinations, approaching IDIC (Infinite Diversity in Infinite Combinations).

This can be quite confusing when translating between googological naming systems, but JMGE can handle them all. The **factorial,** abbreviated to -fa-, and symbolized by an exclamation mark, is an abbreviation for the multiplicative nesting, n! = n(n - 1)! = g(1, g(n - 1, 0, -1, n), n)

**lexexfa** = 70! > g(2, 50, 100), which can be extrapolated to exponential factorial or **expofactorial** (-fij), n!2 = g(2, g(n - 1, 0, -1, n), n), tetrational factorial or **tetratorial** (-fiji), n!3 = g(3, g(n - 1, 0, -1, n), n), Fiji numbers,..., **mixed factorial** (-(e)mfa), n\* = = g(n -1, n, (n - 1)\*), **polyfactorials**, g(n', g(2, n - n', n)), indicated with Latin prefixes, **multifactorials**, g(n', 1, 1, g(2, n - n', n)), indicated with Greek prefixes, Simon and Plouffe's subfactorial or **left factorial** (-(e)lfa), !n = [n!/e] = g[-1, e, g(n - 1, 1, 2, n - 1, n)], **superfactorial,** (sfa), (n + 1)s! = (ns!)!, **hyperfactorial** (-hfa), nh! = g(3, 2, n)(n - 1)h!, Aalbert Torsius's **torian** (-to), a nesting of the factorialization function, not just the itsy-bitsy factorials or the teeny-weeny factorials of factorials, abbreviated with -to-,!n! = !n!(!(n - 1)!) = g(n, 1, 1, g(1, g(n - 1, 0, -1, n), n))

There are alsoBerezin's **supersuperfactorial,** n$! = g(4, 2, n!) = g(4, 2, g(n - 1, 1, 2, n - 1, n)),superhyperfactorial-torian or **shuperfactorian** = nsh!t. The **primorial** (-pfa), in which the nth primes are multiplied, n# = p(n)((p(n))# = g(p(n) - 1, 1, 2, p(n - 1), p(n)). Then there is the torian-like extrapolation from the primorial, the **morian**, #n#, and beyond that the **borian** (-bo)= ##n##**, trorian** (-tro)= ###n###, etc. Although none of these composite numbers can be prime, one or both of their neighbors can be, below Kummer primes, above. Others are balanced (equally distant from their nearest prime neighbors. This in turn can be extrapolated to any function expressible in MGE, in general, (f(n))! = g(f(n) - 1, 1, 2, f(n - 1), f(n)), abbreviated to -ff- and specifically with the substitution -g(n)f-.

Using [**Łukasiewicz logic**](http://en.wikipedia.org/wiki/Łukasiewicz_logic), we can include even incalculable sequences. In the original Polish letter notation with A = disjunction (or), C = implication (if/then), K = conjunction (and), N = negation (not), and Mn = CNnn (not-false), Ln = NMNn (true), In = AMn (unknown), but with the excluded fourth, AAnINn, replacing the excluded middle law, ANnn, and the non-contardiction law, NKnNn, extended to NKKnNInKNn . [Using Gödel's symbolic logic generates huge numbers all by itself!]

**googolfa** = g(g(2, 100, 10), 1, 2, g(g(2, 100, 10), 1, 2, 100, 10) - 1, g(2, 100, 10)) = g(2, !, g(2, 100, 10)) = (10010)!

**googolbifa** = g(2, 1, 2, g(n, 1, 2, 100, 10) - 1, g(2, 100, 10)) = g(2, 1, !, n)!, = (10010)!)!

**googoldufa** = g(2, 1, 1, 2, g(2, 100, 10) - 1, g(2, 100, 10))

**googofal** = g(2, g(50 - 1, 1, 2, 50 - 1, 50), g(100 - 1, 1, 2, 100 - 1, 100)) = 100!50!

**goofagol** = g(2, g(50 - 1, 1, 2, 50 - 1, 50), 100) = 10050!

**fagoogol** = g(n, 1, 1, 1, 1, 2, g(2, 100, 10) - 1, g(2, 100, 10)) =

**goopgolpfa** =g(p(g(2, 100, 10)) - 1, 1, 2, p(g(2, 100, 10) - 1), p(g(2, 100, 10)))

**googolto** =g(g(2, 100, 10), 1, 1, g(2, 100, 10), 1, 1, 2, g(2, 100, 10) - 1, g(2, 100, 10))

These very, very, very small numbers once again confirm the Frivolous Theorem: "Almost all natural numbers are very, very, very large."