

# CRACKING THE PI-CODE

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To the mathematician, pi is "the ratio of the circumference of a circle to its diameter." To the typographer, pi is "jumbled up type." To the cryptologist, however, pi can be considered a string of digits written in code. A pi-code is simple--ten letters replacing ten numbers. If pi were itself decoded, what words would appear?

In order to find out what pi is saying, I tested several pi-codes on a series of pi's digits. After converting digits to letters in each sample, I searched through the resulting jumble for (1) the longest string of words and (2) the total number of letters that produce words. Each pi-code is designated by a ten-letter string in which a letter's position indicates the digit that the letter replaces. In ABCDEFGHIJ, for example, A replaces 1, B replaces 2, C replaces 3, ..., J replaces 0.

Although the digits are random, words show up, at least in the samples checked, more frequently than might be expected. With a good choice of letters in the pi-code, around half of the alphabetical pi spells out words of two or more letters listed in the 1974 Merriam-Webster Pocket Dictionary (boldfaced, single-word entries and their derived forms, but not such netherwords as abbreviations, symbols, contractions, and hyphenations).

The test samples are decoded versions of the first 300 digits to the right of the decimal point in pi.

## PI TO THE 300TH DECIMAL PLACE

Source: Petr Beckman, *A History of Pi* (St. Martin's Press, 1971)

3.1415926535 8979323846 2643383279 5028841971 6939937510  
5820974944 5923078164 0628620899 8628034825 3421170679

8214808651 3282306647 0938446095 5058223172 5359408128  
4811174502 8410270193 8521105559 6446229489 5493038196

4428810975 6659334461 2874564823 3786783165 2712019091  
4564856692 3460348610 4543266482 1339360726 0249141273...

This is merely a grain of sand on an endless beach, but it's enough to give an idea of what can be found by sifting through the digits. Although they occur as a continuous string, they have been separated into sets of ten and blocks of a hundred for easier reading. In the

alphabetically converted samples below, all legal words are capitalized, and overlapping words are allowed (e.g., ALERR = ALE, ERR).

ETAOINSHRD, the set of the ten commonest printed letters, was the first pi-code chosen. When I plugged the code into the computer, E,T,A, ... D replaced 1,2,3, ... 0 throughout the sample, and up came EOEIR... instead of 14159... Out of the 300 random letters, 153 of them, or 51 per cent, formed words. The longest word-string was twelve letters, starting at the 63rd decimal place:

PI-CODE ETAOINSHRD  
153 word-producing letters  
longest word-string, 12 letters

eoairtniai hrsRATahOH tNOaaHATSR IDthHOErse nrarrASied  
ihtdrSORoo irTADSHENO DNTHntdhrr hNTHdaOhti aoTEESdnsr

hteOHdhniE AThtADnNOS drahoONdri IDihttaest iAIRODHETH  
oHEeeSOIDt HOEDtsdERA HITEEDiiir NOONttrOhr iORADaHERN

OothHEdrSI NniraaONE thoSINOhta ASHnshaeNI TSETderdRE  
oINOHINNrt aONdaOHneD OiOATnNOHT EAaRANDstn dTOREoetsa

To see if other letters would do better, I tried a variety of pi-codes and discovered some that generated longer word-strings but fewer word-producing letters. Pi-code AEONTIDPHL, for instance, builds the 16-letter string THEOLDPAINLIEPIE starting at the 61st decimal place. However, only 139 letters (46 per cent) make words.

Taking another approach, I found a section of pi at decimal places 70-79 with a run of all ten different numbers: 5923078164. The word PALINDROME is spelled with ten different letters. Pairing letters with numbers gives the customized pi-code OLIEPMORAN, automatically making the word PALINDROME at the 70th decimal place. Moreover, it generates 159 word-producing letters (53 per cent), six more than ETAOINSHRD.

After a few more attempts, a truly remarkable pi-code emerged: SAREBLTDOI produced a 35-letter string of words, almost twice as long as THEOLDPAINLIEPIE. Not only that, but 189 letters, 63 per cent of the 300, participated in making words. I constructed SAREBLTDOI by customizing an earlier pi-code letter by letter to build the longest possible word-string.

PI-CODE SAREBLTDOI  
185 word-producing letters  
longest word-string, 35 letters

sesBOAlbrb DOTORardel ALERRdRATO biADDeSOTS IORoORTBsi  
bdaioteoe BOARITdsLE ILADLAIDOO DLAIREDAB REASSTILTO

DASeDIDlbs RADARILLET iORdEELioB BIDdaarSTA BrboeIDSAD  
 edssstebIA DesiATISOR dBASSiBBBO LEELaaoeDO BEORirdSOL

EEADDSioTB llBORREELS ADetBLEDar rtdltdrslB ATSaiSOios  
 eBLEDb110A RELIREDlsi eBERALLEDA SrrORLITAl iaeoseSATr

Of course, these results can be increased with a larger dictionary. Including words listed in Webster's New Twentieth Century, for instance, the number of word-producing letters jumps to 243 out of 300--or 81 per cent! The longest word-string grows to 39 letters: LEILADLAIDOOD-LADIREDABREASSTILTODASEDID.

To evaluate the apparent fecundity of pi-code SAREBLTDOI, I plugged in several permutations to see if they would work as well (using the Pocket Dictionary again). Here are some of the results:

Pi-Code	Variant Arrangement	Number	Percent
ABDEILORST	Alphabetized	143	48
AEIOBDLRST	Alphabetized by vowels, consonants	140	47
AREBLTDOIS	Initial S moved to the end	161	54
IODTLBERAS	Reversed	155	52

Most of the other variations I tried generated 140 to 160 word-producing letters and formed no word-strings of great length. However, SAREBNTDOI, which substitutes N for L, gives results almost as good as SAREBLTDOI: 177 letters, and a 33-letter word-string, INADNAIDOODNADI-REDABREASSTINTODAS.

Wondering whether SAREBLTDOI would consistently generate a high per cent of words and exceptionally long word-strings, I extended the search to 1000 decimal places. However, the results are unimpressive: 310 more letters form words, giving a total of 489 out of 1000, or 49 per cent. This lowers the average to 147 words per 300 compared to the 189 letters in the first 300.

Perhaps greater results can be achieved with a different pi-code at a different decimal place: maybe a thousand digits in a row spell a continuous string of words at the millionth decimal place; maybe ten thousand at the billionth. The number of digits in pi is infinite, and the number of pi-codes is vast. When numerical pi is converted to an alphabetical string, the question is: 8941 07 7455 2 7254, 93 234 071 5477431 3452748 27 255? (To translate, use pi-code SARELBTDOI.)

Using the Pocket Dictionary, can anyone find a pi-code that generates (1) a longer word-string than 35 letters, (2) a higher per cent of word-producing letters than 63, or (3) a longer word than PALINDROME? Or, using an unabridged dictionary, a longer word-string than 39 letters and a higher per cent of word-producing letters than 81? The decoding can begin at any decimal place.