(F) 1979 is part of a ten-digit multiplicative bracelet wherein each element is the units' digit of the product of the four preceding digits, namely:

1 9 7 9 7 9 9 3 1 3'1 9 7 9.

(G) 1979 is part of a 1560-digit additive bracelet wherein each element is the units' digit of the sum of the four preceding digits, namely:

19796 13992 33758 33938 33714 ... .

The complete bracelet is included in "A Digital Bracelet for 1967," *The Fibonacci Quarterly* 5 (1967):477-480.

(H) Add the squares of the digits of the integers. $1^2 + 9^2 + 7^2 + 9^2 = 212$. Subsequent terms in the sequence are 9, 81, 65, 61, 37, 58, 89, 145, 42, 20, 4, 16, 37. Six operations to enter an eight-member loop.

(I) Add the cubes of the digits of the integers. $1^3 + 9^3 + 7^3 + 9^3 = 1802$, followed by 521, 134, 92, 737, 713, 371. Seven operations to reach the self-replicating 371.

(J) Add the fourth powers of the digits of the integers. $1^4 + 9^4 + 7^4 + 9^4 = 15524$, then 1523, 723, 2498, 10929, 13139, 6725, 4338, 4514, 1138, 4179, 9219, 13139. Six operations to enter a seven-member loop.

(K) Add the squares of the odd digits to the sum of the even digits. 1979, 212, 5, 25, 27, 51, 26, 8. Seven operations to reach the self-replicating 8.

(L) Add the squares of the even digits to the sum of the odd digits. 1979, 26, 40, 16, 37, 10, 1. Six operations to reach the self-replicating 1.

(M) Add the squares of the composite digits to the sum of the other digits. $1 + 9^2 + 7 + 9^2 = 170$, then 8, 64, 52, 7. Five operations to reach the self-replicating 7.

(N) Add the composite digits to the sum of the squares of the other digits. $1^2 + 9 + 7^2 + 9 = 68$, then 14, 5, 25, 29, 13, 10, 1. Eight operations to reach the self-replicating 1.

(O) For a four-digit integer $abcd$, compute $a^4 + b^3 + c^2 + d$. $1^4 + 9^3 + 7^2 + 9 = 788$, then 415, 70, 49, 25, 9. Six operations to reach the self-replicating 9.

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1979 AND ASSOCIATED PRIMES

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(A) The prime 1979, which contains only one prime digit, is a concatenation of the two primes 19 and 79. Of the seven different two-digit integers that can be formed from the digits of 1979, five are primes. Their sum, 17 + 19 + 71 + 79 + 97 = 283, a prime.

Of the twelve different three-digit integers that can be formed from the digits of 1979, eight are prime. These include two sets consisting of cyclic permutations. The sum of the eight, 197 + 971 + 719 + 199 + 991 + 919 + 179 + 997 = 5172 = 431 • 3 • 4, a palindromic arrangement. Two of the composite integers that are cyclic permutations have factors that are cyclic permutations; that is, 791 = 7 • 113 and 917 = 7 • 131.

Of the 4! permutations of the digits of 1979, five form prime integers: 1979, 1997, 7919, 9719, and 9791.

(B) Since 79 - 19 = 60, both 19 and 79 are members of eleven arithmetic progressions with common differences of d = 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, and 30, respectively. In eight of these, the square 49 is the middle term. Two of these progressions are worthy of note. In

19 31 43 55 67 79

only one term is not a prime, and it is the product of the alternate primes 5 and 11. The other progression

19 25 31 37 43 49 55 61 67 73 79

contains eight primes, two squares, and the product $5 \cdot 11$.

(C)

$2 = 1 - \sqrt{9} + 7 - \sqrt{9}$
$3 = -1 + \sqrt{9} + 7 - (\sqrt{9})!$
$5 = 1 \cdot 9 - 7 + \sqrt{9}$
$7 = 1 \cdot 9 + 7 - 9$
$11 = 1 \cdot 9 - 7 + 9$
$13 = 1\sqrt{9} + 7 + (\sqrt{9})$
$17 = 1 + \sqrt{9} + 7 + (\sqrt{9})!$
$19 = 1\sqrt{9} + 7 + 9$
$23 = 1 + 9 + 7 + (\sqrt{9})!$
$29 = -1 + (\sqrt{9})(7) + 9$
$31 = 1 + (\sqrt{9})(7) + 9$
$37 = (1 + \sqrt{9})7 + 9$
$41 = -1^9 + 7(\sqrt{9})!$
$43 = 1^9 + 7(\sqrt{9})!$
$47 = -1 + (\sqrt{9})! + 7(\sqrt{9})!$
$53 = -1 - 9 + 7 \cdot 9$
$59 = -1 - \sqrt{9} + 7 \cdot 9$
$61 = 1 - \sqrt{9} + 7 \cdot 9$
$67 = 1 + \sqrt{9} + 7 \cdot 9$
$71 = -1 + 9 + 7 \cdot 9$
$73 = 1 + 9 + 7 \cdot 9$
$79 = 1^9 \cdot 79$
$83 = 1 + \sqrt{9} + 79$
$89 = 1 + 9 + 79$
$97 = 1 \cdot 97 \cdot [!(!\sqrt{9})]$

In each of the expressions of the primes < 100, the digits of 1979 are in the same order as in the year. $!x$ is "sub-factorial x." $!3 = 2$ and $!2 = 1$.

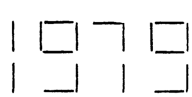
(D) In each of the following sums of distinct primes equal to 1979, the primes are consecutive with the exception of the primes in parentheses.

1979 = (5) + 983 + 991
= (23) + 479 + 487 + 491 + 499
= (23) + 311 + 313 + 317 + 331 + 337 + 347
= (79) + 223 + 227 + 229 + 233 + 239 + 241 + 251 + 257
= (61) + 131 + 137 + 139 + 149 + 151 + 157 + 163 + 167 + 173 + 179 + 181 + 191
= (53) + 103 + 107 + 109 + 113 + 127 + 131 + 137 + 139 + 149 + 151 + 157 + 163 + 167 + 173
= (23) + 83 + 89 + 97 + 101 + 103 + 107 + 109 + 113 + 127 + 131 + 137 + 139 + 149 + 151 + 157 + 163
= (53) + 67 + 71 + 73 + 79 + 83 + 89 + 97 + 101 + 103 + 107 + 109 + 113 + 127 + 131 + 137 + 139 + 149 + 151
= (31) + 53 + 59 + 61 + 67 + 71 + 73 + 79 + 83 + 89 + 97 + 101 + 103 + 107 + 109 + 113 + 127 + 131 + 137 + 139 + 149
= (3 + 5) + 11 + 13 + 17 + 19 + 23 + 29 + 31 + 37 + 41 + 43 + 47 + 53 + 59 + 61 + 67 + 71 + 73 + 79 + 83 + 89 + 97 + 101 + 103 + 107 + 109 + 113 + 127 + 131 + 137
= 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 + 31 + 37 + 41 + 43 + 47 + 53 + 59 + 61 + 67 + 71 + 73 + 79 + 83 + 89 + 97 + 101 + 103 + 107 + 109 + (499)
= 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 + 31 + 37 + 41 + 43 + 47 + 53 + 59 + 61 + 67 + 71 + 73 + 79 + 83 + 89 + 97 + (919)
= 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 + 31 + 37 + 41 + (1741)
= 2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + (1879)
= 2 + 3 + 5 + 7 + 11 + (1951)

(E)

$1979 = 3 \cdot 5 + 19 \cdot 43 + 31 \cdot 37$
$= 5 \cdot 7 + 11 \cdot 137 + 19 \cdot 23$
$= 5 \cdot 67 + 11 \cdot 13 + 19 \cdot 79$
$= 5 \cdot 79 + 19 \cdot 23 + 31 \cdot 37$
$= 7 \cdot 11 + 17 \cdot 59 + 29 \cdot 31$

(F) A prime number, 17, of toothpicks can be assembled into



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