

# 2019 In Numbers

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*This short paper brings representations of 2019 in different situations. These representations are of crazy-type, running numbers, single digit, single letter, Triangular, Fibonacci, palindromic-type, prime numbers, embedded, repeated, magic squares, etc.*

## HAPPY-2019

1 408 613 612	2 407 614 611	3 406 615 610	14 395 626 599	29 380 641 584	28 381 640 585	30 379 642 583	41 368 653 572	42 367 654 571	43 366 655 570
714 511 102 307	713 512 101 308	712 513 100 309	701 524 89 320	686 539 74 335	687 538 75 334	685 540 73 336	674 551 62 347	673 552 61 348	672 553 60 349
204 205 816 409	203 206 815 410	202 207 814 411	191 218 803 422	176 233 788 437	177 232 789 436	175 234 787 438	164 245 776 449	163 246 775 450	162 247 774 451
715 510 103 306	716 509 104 305	717 508 105 304	728 497 116 293	743 482 131 278	742 483 130 279	744 481 132 277	755 470 143 266	756 469 144 265	757 468 145 264
	4 405 616 609								
	711 514 99 310								
	201 208 813 412								
	718 507 106 303								
	5 404 617 608								
	710 515 98 311								
	200 209 812 413								
	719 506 107 302								
8 401 620 605	7 402 619 606	6 403 618 607	17 392 629 596		27 382 639 586	31 378 643 582	40 369 652 573		44 365 656 569
707 518 95 314	708 517 96 313	709 516 97 312	698 527 86 323		688 537 76 333	684 541 72 337	675 550 63 346		671 554 59 350
197 212 809 416	198 211 810 415	199 210 811 414	188 221 800 425		178 231 790 435	174 235 786 439	165 244 777 448		161 248 773 452
722 503 110 299	721 504 109 300	720 505 108 301	730 495 118 291		741 484 129 280	745 480 133 276	754 471 142 267		758 467 146 263
9 400 621 604									
706 519 94 315									
196 213 808 417									
723 502 111 298									
10 399 622 603									
705 520 93 316									
195 214 807 418									
724 501 112 297									
11 398 623 602	12 397 624 601	13 396 625 600	18 391 630 595		24 385 636 589	34 375 646 579			47 362 659 566
704 521 92 317	703 522 91 318	702 523 90 319	697 528 85 324		691 534 79 330	681 544 69 340			668 557 56 353
194 215 806 419	193 216 805 420	192 217 804 421	187 222 799 426		181 228 793 432	171 238 783 442			158 251 770 455
725 500 113 296	726 499 114 295	727 498 115 294	732 493 120 289		738 487 126 283	748 477 136 273			761 464 149 260
			19 390 631 594		23 386 635 590	35 374 647 578			48 361 660 565
			696 529 84 325		692 533 80 329	680 545 68 341			667 558 55 354
			186 223 798 427		182 227 794 431	170 239 782 443			157 252 769 456
			733 492 121 288		737 488 125 284	749 476 137 272			762 463 150 259
			20 389 632 593	21 388 633 592	22 387 634 591	36 373 648 577	51 358 663 562	50 359 662 563	49 360 661 564
			695 530 83 326	694 531 82 327	693 532 81 328	679 546 67 342	664 561 52 357	665 560 53 356	666 559 54 355
			185 224 797 428	184 225 796 429	183 226 795 430	169 240 781 444	154 255 766 459	155 254 767 458	156 253 768 457
			734 491 122 287	735 490 123 286	736 489 124 285	750 475 138 271	765 460 153 256	764 461 152 257	763 462 151 258

*Formed by 51 pan diagonal magic squares of order 4 using consecutive numbers from 1 to 816 with equal magic squares sums,  $S_{4 \times 4} := 1634$ .*

<http://bit.ly/2QF3XtI>

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# 1 Crazy Representations

## 1.1 Single Digit and Letter

### • Single Digit Representations

$$\begin{aligned}
 \mathbf{2019} &:= 1 + (1 + 1)^{11} - (11 - 1) \times (1 + 1 + 1) \\
 &:= (2 \times 22 + 2/2)^2 - 2 - 2 - 2 \\
 &:= 3 + (3 + 3) \times (333 + 3) \\
 &:= 4 + (4 + 4) \times (4^4 - 4) - 4/4 \\
 &:= 5 + 5^5 - 5555/5 \\
 &:= (6 \times (666 + 6) + 6) \times 6 / (6 + 6) \\
 &:= (77 - 7) / 7 + 7 \times (7 \times (7 \times 7 - 7) - 7) \\
 &:= 88 + (8 + 8) \times (8 \times (8 + 8) - 8) + 88/8 \\
 &:= 9 + (9999 - 9) / 9 + 9 \times 99 + 9.
 \end{aligned}$$

19-1

<http://bit.ly/2SqIbKD>  
<http://bit.ly/2wnbUey>.

### • Single Letter Representation

$$\mathbf{2019} := \frac{\frac{(aaaaa - a) \times (a + a)}{aa} - a}{a}$$

or,

$$\begin{aligned}
 \mathbf{2019} &:= \frac{(aaaaa - a) \times (a + a) - a \times aa}{a \times aa} \\
 &:= \frac{(aaaaa - a) \times (a + a)}{a \times aa} - \frac{a}{a}.
 \end{aligned}$$

$$\begin{aligned}
 \text{where, } aaaaa &= a10^4 + a10^3 + a10^2 + a10 + a, \\
 aa &= a10 + a, \quad a \in \{1, 2, 3, 4, 5, 6, 7, 8, 9\}.
 \end{aligned}$$

19-2

<http://bit.ly/2QB5HXt>  
<http://bit.ly/2zJNoFM>

## 1.2 1 to 9 Numbers: Increasing and Decreasing

### • Basic Operations

$$\begin{aligned} 2019 &:= 1 + 2 \times 34 + 5 \times 6 \times (7 \times 8 + 9) \\ &:= 98 + 7 + 65 + 43^2 \times 1. \end{aligned}$$

### • Factorial

$$\begin{aligned} 2019 &:= (1 + 2) \times (3!! - 4! - 5 + 6 - 7 - 8 - 9) \\ &:= 9 + (8 + 7) \times (6!/5 - 4 - 3 - 2 - 1). \end{aligned}$$

### • Square-Root

$$\begin{aligned} 2019 &:= -1 \times (2 + 3) + \sqrt{4^{5+6}} - 7 - 8 - 9 \\ &:= \sqrt{9} + 8 - 7 + 65 \times (4 + 3^{2+1}). \end{aligned}$$

### • Fibonacci Sequence

$$\begin{aligned} 2019 &:= 12 \times F(3) \times F(4) \times 5 + F(F(6)) \times (7 + 8 \times 9) \\ &:= F(9) \times 8 \times 7 + 65 + (4 + 3)^2 + 1 \end{aligned}$$

### • Triangular Numbers

$$\begin{aligned} 2019 &:= 1 - 2 + T(3)^4 + 56 - 7 + T(T(8)) + 9 \\ &:= (9 + 8 + 7) \times 6 \times (5 \times 4 - T(3)) + 2 + 1. \end{aligned}$$

19-3

<http://bit.ly/2wnZq6g>  
<http://bit.ly/2AYFpoc>

## 1.3 Numbers 1 to 10: Increasing and Decreasing

### • Numbers 1 to 10: Increasing and Decreasing

$$\begin{aligned} 2019 &:= (1 + 2) \times 3 + (45 + 67 + 89) \times 10 \\ &:= 10 \times (-9 + (8 + 7) \times (-6 + 5 \times 4)) + 3 \times (2 + 1). \end{aligned}$$

19-4

<http://bit.ly/2AYFpoc>.

## 1.4 Same Digits in Bases and Powers

### • Same Digits in Bases and Powers

$$\begin{aligned} 2019 &:= 2^9 + 3^7 + 7^2 - 9^3 \\ &:= 0^3 + 1^8 + 2^7 - 3^9 + 4^6 + 5^4 + 6^2 + 7^5 + 8^1 + 9^0. \end{aligned}$$

19-5

<http://bit.ly/2PfAW64>  
<http://bit.ly/2MBcK9H>.

## 2 Power Representations

### • Power 2

$$\begin{aligned} 2019 &:= 1^2 + 13^2 + 43^2 = 5^2 + 25^2 + 37^2 \\ &:= 7^2 + 11^2 + 43^2 = 7^2 + 17^2 + 41^2 \\ &:= 11^2 + 23^2 + 37^2 = 13^2 + 25^2 + 35^2 \\ &:= 17^2 + 19^2 + 37^2. \end{aligned}$$

$$\begin{aligned} 2019 &:= 17^2 + 23^2 + 24^2 + 25^2 \\ &:= 15^2 + 17^2 + 20^2 + 23^2 + 24^2 \\ &:= 15^2 + 16^2 + 17^2 + 18^2 + 21^2 + 22^2. \end{aligned}$$

### • Power 3

$$2019 := 1^3 + 1^3 + 7^3 + 7^3 + 11^3$$

### • Power 4

$$2019 := 1^4 + 2^4 + 3^4 + 5^4 + 6^4.$$

19-6

- Sequential Powers of 2

$$2019 := 2^{10} + 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^4 - 2^3 - 2^2 - 2^1 + 2^0.$$

(19-7)

- Symmetric

$$\begin{aligned} 2019 &:= 15^2 + 28^2 + 1^2 + 28^2 + 15^2 \\ &:= 1^3 + 7^3 + 11^3 + 7^3 + 1^3. \end{aligned}$$

- Prime Multiplications

$$\begin{aligned} 2017 &:= 1 \times 2017 \rightarrow 1 \text{ times prime number} \\ 2018 &:= 2 \times 1009 \rightarrow 2 \text{ times prime number} \\ 2019 &:= 3 \times 673 \rightarrow 3 \text{ times prime number.} \end{aligned}$$

- Pythagorean Triples

$$\begin{aligned} 2017^2 &:= 792^2 + 1855^2 \\ 2018^2 &:= 1118^2 + 1680^2 \\ 2019^2 &:= 1155^2 + 1656^2 \\ 2020^2 &:= 400^2 + 1980^2 = 868^2 + 1824^2 \\ &:= 1212^2 + 1616^2 = 1344^2 + 1508^2. \end{aligned}$$

(19-8)

• Pattern with Power 4

$$0\,2019 := 1^4 + 2^4 + 3^4 + 5^4 + 6^4$$

$$1\,2019 := 1^4 + 2^4 + 3^4 + 5^4 + 6^4 + 10^4$$

$$2\,2019 := 4^4 + 5^4 + 7^4 + 8^4 + 11^4$$

$$3\,2019 := 1^4 + 5^4 + 8^4 + 9^4 + 12^4$$

$$4\,2019 := 3^4 + 9^4 + 11^4 + 12^4$$

$$5\,2019 := 1^4 + 2^4 + 3^4 + 6^4 + 15^4$$

$$:= 3^4 + 9^4 + 10^4 + 11^4 + 12^4$$

$$6\,2019 := 7^4 + 9^4 + 11^4 + 14^4$$

$$7\,2019 := 4^4 + 7^4 + 8^4 + 11^4 + 15^4$$

$$:= 7^4 + 9^4 + 10^4 + 11^4 + 14^4$$

$$8\,2019 := 1^4 + 8^4 + 9^4 + 12^4 + 15^4$$

$$9\,2019 := 2^4 + 5^4 + 6^4 + 9^4 + 17^4.$$

### 3 Same Digits Equality Expressions

#### • Same Digits Equality Expressions

$$\begin{aligned}
 21 \times 10095 &= 105 \times 2019 \\
 192 \times 4038 &= 384 \times 2019 \\
 219 \times 4038 &= 438 \times 2019 \\
 129 \times 7403 &= 473 \times 2019 \\
 1902 \times 4038 &= 2019 \times 3804 \\
 39 \times 203919 &= 2019 \times 3939 \\
 1992 \times 4038 &= 2019 \times 3984 \\
 2199 \times 4038 &= 2019 \times 4398 \\
 39 \times 224109 &= 2019 \times 4329 \\
 103 \times 92874 &= 2019 \times 4738 \\
 129 \times 74703 &= 2019 \times 4773 \\
 104 \times 92874 &= 2019 \times 4784 \\
 106 \times 92874 &= 2019 \times 4876
 \end{aligned}$$

19-10

<http://bit.ly/2ndFyO6>

#### • Power and Plus

$$2019 := 1^6 + 44^2 + 75^0 + 81^1 = 16 + 442 + 750 + 811.$$

19-11

<http://bit.ly/2PRrfw3>
<http://bit.ly/2PQIE86>

### • Factorial and Power

$$\begin{aligned}
 10 \times 2019 + 0 &:= (1! + 5! + 6!) \times 4! + 3! = 1^4 + 5^3 + 6^5 + 4^6 \times 3^1 \\
 &:= 3! + 4! \times (1! + 5! + 6!) = 3^1 \times 4^6 + 1^4 + 5^3 + 6^5 \\
 10 \times 2019 + 2 &:= (1! + 6! + 5!) \times 4! + 2! + 3! = 1^6 + 6^2 + (5^4 + 4^1) \times 2^5 + 3^3 \\
 &:= 2! + 4! \times (1! + 6! + 5!) + 3! = 2^5 \times 4^3 \times 1^6 + 6^4 \times (5^1 + 3^2) \\
 10 \times 2019 + 6 &:= (1! + 5! + 6!) \times 4! + 2! \times 3! = (1^5 + 5^2) \times 6^3 + (4^1 + 2^4) \times 3^6 \\
 &:= 2! \times 3! + (1! + 5! + 6!) \times 4! = 2^1 + 3^6 \times (1^4 + 5^2) + 6^3 + 4^5.
 \end{aligned}$$

19-12

<http://bit.ly/2C1qNZc>  
<http://bit.ly/2wwXPKI>

### • Fibonacci and Triangular

$$\begin{aligned}
 2019 &:= F(4) \times (F(1) + F(8) \times (F(9) - F(3))) = (T(4) - T(1) + T(8)) \times T(9) - T(3) \\
 &:= ((-F(3) + F(9)) \times F(8) + F(1)) \times F(4) = -T(3) + T(9) \times T(8) - T(1) + T(4).
 \end{aligned}$$

19-13

<http://bit.ly/2LBt5NX>  
<http://bit.ly/2POXoUI>

## 4 Selfie and Equivalent Fractions

### • Selfie Fractions

$$\frac{2019}{673} := \frac{201 + 9}{67 + 3} = \frac{201 - 9}{67 - 3} = \frac{20 \times 1 \times 9}{6 \times (7 + 3)}$$

$$\frac{2019}{5384} := \frac{20 \times 1 \times 9}{5 \times 3 \times 8 \times 4}$$

$$\begin{aligned}
 \frac{2019}{367458} &:= \frac{2 \times 01 \times 9}{(3 + 6) \times 7 \times 4 \times (5 + 8)} \\
 &:= \frac{2 \times (01 + 9)}{(3 + 67) \times 4 \times (5 + 8)}.
 \end{aligned}$$

19-14

<http://bit.ly/2BYMDMJ>  
<http://bit.ly/2LIHb0k>

- Equivalent Fractions

$$\begin{aligned}
 \frac{2019}{367458} &= \frac{1509}{274638} = \frac{1794}{326508} = \frac{1896}{345072} = \frac{1908}{347256} = \frac{1962}{357084} \\
 &= \frac{2097}{381654} = \frac{2973}{541086} = \frac{3018}{549276} = \frac{4056}{738192} = \frac{5043}{917826} \\
 &= \frac{5046}{918372} = \frac{5103}{928746} = \frac{5301}{964782}.
 \end{aligned}$$

19-15

<http://bit.ly/2NvMiCC>.

## 5 Fibonacci and Triangular Type Representations

- Running-Type

$$\begin{aligned}
 2019 &:= 1 + 2 + T(3 + 4 \times T(5)) = T(6) \times T(7) + T(8 + T(9)) \\
 &:= -6 + (F(F(7)) - 8) \times 9 \\
 &:= 9 \times (-8 + F(F(7))) - 6 = 5^4 \times 3 + F(2 + 10).
 \end{aligned}$$

- Partial Sums

$$\begin{aligned}
 2019 &:= 12 \times 34 \times 5 - T(6) &= 654 \times 3 + 2 + T(10) \\
 & &= 654 \times 3 + 2 + F(10) \\
 &:= 4 + T(56 + 7) + 8 - 9 &= -T(9 + 8) - T(7) + T(65) + T(T(4)) \\
 &:= 1 + 2 + T(3 + 4 \times T(5)) = T(T(5) \times 4 + 3) + 2 + 1 \\
 &:= 12 \times 34 \times 5 - F(F(6)) &= -6 + (5 \times F(4) \times 3)^2 \times 1 \\
 &:= 4 + 5 + 67 \times (F(8) + 9) &= -T(9 + 8) - T(7) + T(65) + T(T(4)).
 \end{aligned}$$

19-16

<http://bit.ly/2LDuSiN>  
<http://bit.ly/2AfpCli>.

## 6 Upside Down, Mirror Looking and Symmetric

### 6.1 Upside Down with Digits 1, 6 and 9

- Upside Down with Digits 1, 6 and 9

$$\begin{aligned}
 \mathbf{2019} &:= 1 + 1 + 11 + 1961 + (1 + 1 + 1) \times (6 + 9) \\
 &:= 1 + 1 + 1 + 6 + 9 + 69 \times (1 + 1 + 1 + 11 + 6 + 9) \\
 &:= 1 + 1 + 1 + 6 + 9 + 96 + (1 + 1 + 1) \times (619 + 6 + 1 + 9).
 \end{aligned}$$

$$|+|+||+|96|+(|+|+|) \times (6+9)$$

$$|+|+|+6+9+69 \times (|+|+|+||+6+9)$$

$$|+|+|+6+9+96+(|+|+|) \times (6+|+9+6|9)$$

19-17

### 6.2 Upside Down with Digits 0, 1, 6 and 9

- Upside Down with Digits 0, 1, 6 and 9

$$\begin{aligned}
 \mathbf{2019} &:= 9 + 1001 + 1 + 1 + 1001 + 6 \\
 &:= 9 + 69 + 609 + 619 + 1 + 1 + 609 + 96 + 6 \\
 &:= 1 + 1 + 609 + (1 + 1) \times (1 + 6 + 9 + 69 + 619)
 \end{aligned}$$

$$9+|00|+|+|+|00|+6$$

$$9+69+609+|+6|9+|+609+96+6$$

$$|+|+609+(|+|) \times (|+6+9+69+6|9)$$

19-18

## 6.3 Symmetric, Upside Down and Mirror Looking

### • Symmetric, Upside Down and Mirror Looking

$$\begin{aligned}
 2019 &:= 8 + 1001 + 1 + 1001 + 8 \\
 &:= 502 + 502 + 11 + 502 + 502 \\
 &:= 2 + 1 + 5 + 1001 + 1 + 1001 + 5 + 1 + 2
 \end{aligned}$$

$$\begin{aligned}
 &=: 2019 := \\
 &8 \div 1001 \div 1 \div 1001 \div 8 \\
 &502 \div 502 \div 11 \div 502 \div 502 \\
 &2 \div 1 \div 5 \div 1001 \div 1 \div 1001 \div 5 \div 1 \div 2
 \end{aligned}$$

*In the mirror, 2 becomes 5 and 5 becomes 2*

19-19

## 7 Functional Representations

### 7.1 Fibonacci Sequences

#### • Fibonacci Sequence Representation

$$\begin{aligned}
 F(0) = F(1) = 1, F(n) = F(n-1) + F(n-2), n \geq 2, \\
 0, 1, 1, 2, 3, 5, 8, 13, ..
 \end{aligned}$$

Then,

$$2019 := F(4) + F(6) + F(9) + F(14) + F(17).$$

19-20

<http://bit.ly/2KtOCi6>  
<http://bit.ly/2AEfntK>.

## 7.2 Polygonal-Type: S-gonal

### • Polygonal-Type: S-gonal Representations

The general formula for  $s$ -sides of a polygon (**s-gonal**) is known as

$$P_s(n) := \frac{n(n-1)(s-2)}{2} + n, \quad s > 2.$$

Below are particular cases:

**Triangle (3-gonal):**  $P_3(n) = n(n+1)/2 \rightarrow 2019 := P_3(2) + P_3(63) := T(2) + T(63)$

**Square (4-gonal):**  $P_4(n) = n^2 \rightarrow 2019 := P_4(1) + P_4(13) + P_4(43) := Q(1) + Q(13) + Q(43)$

**Pentagonal (5-gonal):**  $P_5(n) = n(3n-1)/2 \rightarrow 2019 := P_5(1) + P_5(8) + P_5(36) := P(1) + P(8) + P(36)$

**Hexagonal (6-gonal):**  $P_6(n) = n(2n-1) \rightarrow 2019 := P_6(7) + P_6(19) + P_6(25) := H(7) + H(19) + H(25).$

19-21

<http://bit.ly/2KtOCi6>

<http://bit.ly/2AEfntK>

## 8 Embedded Palindromic Primes

### 8.1 Embedded Palprimes With Digits 2, 0, 1 and 9

#### • Embedded Palprimes With Digits 2, 0, 1 and 9

120191021  
 11201910211  
 9112019102119  
 9219112019102119129  
 12921911201910211912921  
 90212921911201910211912921209  
 90190212921911201910211912921209109  
 99290190212921911201910211912921209109299  
 9192992901902129219112019102119129212091092992919  
 9229192992901902129219112019102119129212091092992919229  
 922192291929929019021292191120191021191292120910929929192291229  
 ...      ...      ...      ...      ...      ...

19-22

<http://bit.ly/2LNE63H>

<http://bit.ly/2KzKHcJ>

• Embedded Palprimes With Digits 2, 0, 1 and 9

910212019  
 1191021201911  
 1021191021201911201  
 1021021191021201911201201  
 99102102119102120191120120199  
 9991021021191021201911201201999  
 100299910210211910212019112012019992001  
 1211110029991021021191021201911201201999200111121  
 1211211110029991021021191021201911201201999200111121121  
 1291211211110029991021021191021201911201201999200111121121921  
 9211291211211110029991021021191021201911201201999200111121121921129  
 9299211291211211110029991021021191021201911201201999200111121121921129929  
 ...      ...      ...      ...      ...      ...

19-23

<http://bit.ly/2LNE63H>  
<http://bit.ly/2KzKHcJ>.

• Embedded Palprimes With Digits 2, 0, 1 and 9

12019291021  
 10112019291021101  
 1101120192910211011  
 1021101120192910211011201  
 190210211011201929102110112012091  
 11911902102110112019291021101120120911911  
 991191190210211011201929102110112012091191199  
 992991191190210211011201929102110112012091191199299  
 19929929911911902102110112019291021101120120911911992992991  
 902111992992991191190210211011201929102110112012091191199299299111209  
 10919021119929929911911902102110112019291021101120120911911992992991112091901  
 9021109190211199299299119119021021101120192910211011201209119119929929911120919011209  
 ...      ...      ...      ...      ...      ...

19-24

<http://bit.ly/2LNE63H>  
<http://bit.ly/2KzKHcJ>.

• Embedded Palprimes With Digits 2, 0, 1 and 9

19102920191  
911910292019119  
992911910292019119299  
12019929119102920191192991021  
19112019929119102920191192991021191  
90919112019929119102920191192991021191909  
9901909191120199291191029201911929910211919091099  
9929901909191120199291191029201911929910211919091099299  
902199299019091911201992911910292019119299102119190910992991209  
99021992990190919112019929119102920191192991021191909109929912099  
90199021992990190919112019929119102920191192991021191909109929912099109  
9902901990219929901909191120199291191029201911929910211919091099299120991092099  
... ..  

19-25

<http://bit.ly/2LNE63H>  
<http://bit.ly/2KzKHcJ>

8.2 Palprimes with 2019

Palprimes with 2019

120191021	12019291021	79102320197	91025952019
910212019	19102620191	79102520197	91026562019
910242019	19102920191	91020402019	91027972019
910272019	39102120193	91020502019	91028482019
	39102720193	91025752019	99102420199.

There are much more *palprimes* with 2019, but only few are written.

19-26

<http://bit.ly/2KzKHcJ>

## 9 Magic Squares Type Embedded Palprimes

### • Magic Squares Type Embedded Palprimes

7	9	9	1	1	1	9	9	7
9	1	0	2	1	2	0	1	9
9	0	7	4	1	4	7	0	9
1	2	4	5	1	5	4	2	1
1	1	1	1	9	1	1	1	1
1	2	4	5	1	5	4	2	1
9	0	7	4	1	4	7	0	9
9	1	0	2	1	2	0	1	9
7	9	9	1	1	1	9	9	7

*Palprimes in rows, columns and principal diagonals.*

### • Embedded Palprimes Property

111191111  
 907414709 124515421 111191111 124515421 907414709  
 910212019 907414709 124515421 111191111 124515421 907414709 910212019  
 799111997 910212019 907414709 124515421 111191111 124515421 907414709 910212019 799111997

19-27

<http://bit.ly/2wvJ6jc>  
<http://bit.ly/2LEGuEY>.

### • Magic Squares Type Embedded Palprimes

9	7	9	9	3	9	9	7	9
7	5	1	7	0	7	1	5	7
9	1	0	2	1	2	0	1	9
9	7	2	1	6	1	2	7	9
3	0	1	6	8	6	1	0	3
9	7	2	1	6	1	2	7	9
9	1	0	2	1	2	0	1	9
7	5	1	7	0	7	1	5	7
9	7	9	9	3	9	9	7	9

*Palprimes in rows, columns and principal diagonals.*

### • Embedded Palprime Property

301686103  
 972161279 3016861039 72161279  
 910212019 972161279 3016861039 72161279 910212019  
 979939979 751707157 910212019 972161279 3016861039 72161279 910212019 751707157 979939979

- Magic Squares Type Embedded Palprimes

1	9	9	1	7	1	9	9	1
9	1	0	2	4	2	0	1	9
9	0	7	9	9	9	7	0	9
1	2	9	9	1	9	9	2	1
7	4	9	1	5	1	9	4	7
1	2	9	9	1	9	9	2	1
9	0	7	9	9	9	7	0	9
9	1	0	2	4	2	0	1	9
1	9	9	1	7	1	9	9	1

*Palprimes in rows, columns and principal diagonals.*

- Embedded Property

749151947  
 129919921 749151947 129919921  
 907999709 129919921 749151947 129919921 907999709  
 199171991 910242019 907999709 129919921 74915194 7129919921 907999709 910242019 199171991

19-29

<http://bit.ly/2wvJ6jc>  
<http://bit.ly/2LEGuEY>.

- Magic Squares Type Embedded Palprimes

1	3	9	9	9	9	9	3	1
3	8	1	7	9	7	1	8	3
9	1	0	2	7	2	0	1	9
9	7	2	6	1	6	2	7	9
9	9	7	1	1	1	7	9	9
9	7	2	6	1	6	2	7	9
9	1	0	2	7	2	0	1	9
3	8	1	7	9	7	1	8	3
1	3	9	9	9	9	9	3	1

*Palprimes in rows, columns and principal diagonals.*

- Embedded Property

997111799  
 972616279 997111799 972616279  
 381797183 910272019 972616279 997111799 972616279 910272019 381797183  
 139999931 381797183 910272019 972616279 997111799 972616279 910272019 381797183 139999931

19-30

<http://bit.ly/2wvJ6jc>  
<http://bit.ly/2LEGuEY>.

## 10 Fixed Digits Repetitions Prime Patterns

- Fixed Digits Repetitions Prime Pattern

► 2 3833  
 2 2019 3833  
 2 2019 2019 3833  
 2 2019 2019 2019 3833  
 2 2019 2019 2019 2019 3833  
 2 2019 2019 2019 2019 2019 3833.

19-31

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2wELt3l>.

• Fixed Digits Repetitions Prime Pattern

► 3 9409  
 3 2019 9409  
 3 2019 2019 9409  
 3 2019 2019 2019 9409  
 3 2019 2019 2019 2019 9409  
 3 2019 2019 2019 2019 2019 9409.

19-32

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2wELt3l>.

• Fixed Digits Repetitions Prime Pattern

► 8 6851  
 8 2019 6851  
 8 2019 2019 6851  
 8 2019 2019 2019 6851  
 8 2019 2019 2019 2019 6851  
 8 2019 2019 2019 2019 2019 6851.

19-33

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2wELt3l>.

• Fixed Digits Repetitions Prime Pattern

► 133541  
 133541 2019  
 133541 2019 2019  
 133541 2019 2019 2019  
 133541 2019 2019 2019 2019  
 133541 2019 2019 2019 2019 2019.

19-34

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2wELt3l>.

• Fixed Digits Repetitions Prime Pattern

▶ 122 2019  
 122 252 2019  
 122 252 252 2019  
 122 252 252 252 2019  
 122 252 252 252 252 2019  
 122 252 252 252 252 252 2019  
 122 252 252 252 252 252 252 2019.

19-35

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2MBIeV8>.

• Fixed Digits Repetitions Prime Pattern

▶ 1570 2019  
 1570 99 2019  
 1570 99 99 2019  
 1570 99 99 99 2019  
 1570 99 99 99 99 2019  
 1570 99 99 99 99 99 2019  
 1570 99 99 99 99 99 99 2019.

19-36

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2MBIeV8>.

• Fixed Digits Repetitions Prime Pattern

▶ 3757 2019  
 3757 15 2019  
 3757 15 15 2019  
 3757 15 15 15 2019  
 3757 15 15 15 15 2019  
 3757 15 15 15 15 15 2019  
 3757 15 15 15 15 15 15 2019.

19-37

<http://bit.ly/2wqeIHt>  
<http://bit.ly/2MBIeV8>.

## 11 Palindromic-Type Expressions and Patterns

### 11.1 Palindromic-Type Expressions

$$\begin{aligned}
 0 \text{ 2019} \times 101 + 101 \times \text{9102 0} &= 0 \text{ 203919} + 919302 \text{ 0} \\
 1 \text{ 2019} \times 101 + 101 \times \text{9102 1} &= 1 \text{ 213919} + 919312 \text{ 1} \\
 2 \text{ 2019} \times 101 + 101 \times \text{9102 2} &= 2 \text{ 223919} + 919322 \text{ 2} \\
 3 \text{ 2019} \times 101 + 101 \times \text{9102 3} &= 3 \text{ 233919} + 919332 \text{ 3} \\
 4 \text{ 2019} \times 101 + 101 \times \text{9102 4} &= 4 \text{ 243919} + 919342 \text{ 4} \\
 5 \text{ 2019} \times 101 + 101 \times \text{9102 5} &= 5 \text{ 253919} + 919352 \text{ 5} \\
 6 \text{ 2019} \times 101 + 101 \times \text{9102 6} &= 6 \text{ 263919} + 919362 \text{ 6} \\
 7 \text{ 2019} \times 101 + 101 \times \text{9102 7} &= 7 \text{ 273919} + 919372 \text{ 7} \\
 8 \text{ 2019} \times 101 + 101 \times \text{9102 8} &= 8 \text{ 283919} + 919382 \text{ 8} \\
 9 \text{ 2019} \times 101 + 101 \times \text{9102 9} &= 9 \text{ 293919} + 919392 \text{ 9}
 \end{aligned}$$

19-38

<http://bit.ly/2om0FP5>  
<http://bit.ly/2vBzRxt>  
<http://http://bit.ly/2vmiqRY>

$$\begin{aligned}
 10 \text{ 2019} \times 101 + 101 \times \text{9102 01} &= 10 \text{ 303919} + 919303 \text{ 01} \\
 11 \text{ 2019} \times 101 + 101 \times \text{9102 11} &= 11 \text{ 313919} + 919313 \text{ 11} \\
 12 \text{ 2019} \times 101 + 101 \times \text{9102 21} &= 12 \text{ 323919} + 919323 \text{ 21} \\
 13 \text{ 2019} \times 101 + 101 \times \text{9102 31} &= 13 \text{ 333919} + 919333 \text{ 31} \\
 14 \text{ 2019} \times 101 + 101 \times \text{9102 41} &= 14 \text{ 343919} + 919343 \text{ 41} \\
 15 \text{ 2019} \times 101 + 101 \times \text{9102 51} &= 15 \text{ 353919} + 919353 \text{ 51} \\
 16 \text{ 2019} \times 101 + 101 \times \text{9102 61} &= 16 \text{ 363919} + 919363 \text{ 61} \\
 17 \text{ 2019} \times 101 + 101 \times \text{9102 71} &= 17 \text{ 373919} + 919373 \text{ 71} \\
 18 \text{ 2019} \times 101 + 101 \times \text{9102 81} &= 18 \text{ 383919} + 919383 \text{ 81} \\
 19 \text{ 2019} \times 101 + 101 \times \text{9102 91} &= 19 \text{ 393919} + 919393 \text{ 91.}
 \end{aligned}$$

19-39

<http://bit.ly/2om0FP5>  
<http://bit.ly/2vBzRxt>  
<http://http://bit.ly/2vmiqRY>

$$\begin{aligned}
0 \text{ 2019} \times 10101 + 10101 \times \text{9102 0} &= 0 \text{ 20393919} + 91939302 \text{ 0} \\
1 \text{ 2019} \times 10101 + 10101 \times \text{9102 1} &= 1 \text{ 21403919} + 91940312 \text{ 1} \\
2 \text{ 2019} \times 10101 + 10101 \times \text{9102 2} &= 2 \text{ 22413919} + 91941322 \text{ 2} \\
3 \text{ 2019} \times 10101 + 10101 \times \text{9102 3} &= 3 \text{ 23423919} + 91942332 \text{ 3} \\
4 \text{ 2019} \times 10101 + 10101 \times \text{9102 4} &= 4 \text{ 24433919} + 91943342 \text{ 4} \\
5 \text{ 2019} \times 10101 + 10101 \times \text{9102 5} &= 5 \text{ 25443919} + 91944352 \text{ 5} \\
6 \text{ 2019} \times 10101 + 10101 \times \text{9102 6} &= 6 \text{ 26453919} + 91945362 \text{ 6} \\
7 \text{ 2019} \times 10101 + 10101 \times \text{9102 7} &= 7 \text{ 27463919} + 91946372 \text{ 7} \\
8 \text{ 2019} \times 10101 + 10101 \times \text{9102 8} &= 8 \text{ 28473919} + 91947382 \text{ 8} \\
9 \text{ 2019} \times 10101 + 10101 \times \text{9102 9} &= 9 \text{ 29483919} + 91948392 \text{ 9}
\end{aligned}$$

19-40

<http://bit.ly/2om0FP5>  
<http://bit.ly/2vBzRxt>  
<http://http://bit.ly/2vmiqRY>

$$\begin{aligned}
10 \text{ 2019} \times 10101 + 10101 \times \text{9102 01} &= 10 \text{ 30493919} + 91939403 \text{ 01} \\
11 \text{ 2019} \times 10101 + 10101 \times \text{9102 11} &= 11 \text{ 31503919} + 91940413 \text{ 11} \\
12 \text{ 2019} \times 10101 + 10101 \times \text{9102 21} &= 12 \text{ 32513919} + 91941423 \text{ 21} \\
13 \text{ 2019} \times 10101 + 10101 \times \text{9102 31} &= 13 \text{ 33523919} + 91942433 \text{ 31} \\
14 \text{ 2019} \times 10101 + 10101 \times \text{9102 41} &= 14 \text{ 34533919} + 91943443 \text{ 41} \\
15 \text{ 2019} \times 10101 + 10101 \times \text{9102 51} &= 15 \text{ 35543919} + 91944453 \text{ 51} \\
16 \text{ 2019} \times 10101 + 10101 \times \text{9102 61} &= 16 \text{ 36553919} + 91945463 \text{ 61} \\
17 \text{ 2019} \times 10101 + 10101 \times \text{9102 71} &= 17 \text{ 37563919} + 91946473 \text{ 71} \\
18 \text{ 2019} \times 10101 + 10101 \times \text{9102 81} &= 18 \text{ 38573919} + 91947483 \text{ 81} \\
19 \text{ 2019} \times 10101 + 10101 \times \text{9102 91} &= 19 \text{ 39583919} + 91948493 \text{ 91}
\end{aligned}$$

19-41

<http://bit.ly/2om0FP5>  
<http://bit.ly/2vBzRxt>  
<http://http://bit.ly/2vmiqRY>

## 11.2 Palindromic-Type Patterns

$$\begin{aligned}
 2019 \times 101 + 101 \times 9102 &= 203919 + 919302 &:= 1123221 \\
 2019 \times 10101 + 10101 \times 9102 &= 20393919 + 91939302 &:= 112333221 \\
 2019 \times 1010101 + 1010101 \times 9102 &= 2039393919 + 9193939302 &:= 11233333221 \\
 2019 \times 101010101 + 101010101 \times 9102 &= 203939393919 + 919393939302 &:= 1123333333221
 \end{aligned}$$

19-42

<http://bit.ly/2vBzRxt>  
<http://bit.ly/2vCuYEK>

$$\begin{aligned}
 2019 \times 10001 + 10001 \times 9102 &= 20192019 + 91029102 &:= 111221121 \\
 2019 \times 100001 + 100001 \times 9102 &= 201902019 + 910209102 &:= 1112111121 \\
 2019 \times 1000001 + 1000001 \times 9102 &= 2019002019 + 9102009102 &:= 11121011121 \\
 2019 \times 10000001 + 10000001 \times 9102 &= 20190002019 + 91020009102 &:= 111210011121
 \end{aligned}$$

19-43

<http://bit.ly/2vBzRxt>  
<http://http://bit.ly/2vmiqRY>

# 12 Magic Squares

## 12.1 Upside Down Magic Square of Order 4

Upside Down Magic Square with Digits 2, 0, 1 and 9

00	11	22	99
29	92	01	10
91	20	19	02
12	09	90	21

The above magic square is of magic sum,  $S_{4 \times 4} := 132$  with digits 2, 0, 1 and 9. 180° rotation give again a magic square with digits 2, 0, 1 and 6 with magic sum,  $S_{4 \times 4} := 99$ .

19-44

<https://arxiv.org/abs/1005.1384>  
<https://arxiv.org/abs/1010.2083>  
<https://arxiv.org/abs/1010.4186>

## 12.2 Upside Down Magic Square of Order 5

### • Upside Down Magic Square with 2019

00	99	22	11	66
12	61	06	90	29
96	20	19	62	01
69	02	91	26	10
21	16	60	09	92

The above magic square of order 5 is of magic sum 198 with digits 2, 0, 1, 6 and 9. 180° rotation give again a magic square with same digits and same magic sum,  $S_{5 \times 5} := 198$ . Moreover, it is pan diagonal magic square of order 5. This magic sum can also be written as upside down by writing as

$$198 = 99 + 66 + 22 + 11$$

19-45

<https://arxiv.org/abs/1005.1384>

<https://arxiv.org/abs/1010.2083>

<https://arxiv.org/abs/1010.4186>

## 12.3 Equal Sums Magic Squares of Order 4

### • Equal Sums Magic Squares of Order 4

1 408 613 612	2 407 614 611	3 406 615 610	4 405 616 609	5 404 617 608	6 403 618 607	7 402 619 606	8 401 620 605	9 400 621 604	10 399 622 603	11 398 623 602	12 397 624 601	13 396 625 600	14 395 626 599	15 394 627 598	16 393 628 597	17 392 629 596	18 391 630 595	19 390 631 594	20 389 632 593	21 388 633 592	22 387 634 591	23 386 635 590	24 385 636 589	25 384 637 588	26 383 638 587	27 382 639 586	28 381 640 585	29 380 641 584	30 379 642 583	31 378 643 582	32 377 644 581	33 376 645 580	34 375 646 579	35 374 647 578	36 373 648 577	37 372 649 576	38 371 650 575	39 370 651 574	40 369 652 573	41 368 653 572	42 367 654 571	43 366 655 570	44 365 656 569	45 364 657 568	46 363 658 567	47 362 659 566	48 361 660 565	49 360 661 564	50 359 662 563	51 358 663 562	52 357 664 561	53 356 665 560	54 355 666 559	55 354 667 558	56 353 668 557	57 352 669 556	58 351 670 555	59 350 671 554	60 349 672 553	61 348 673 552	62 347 674 551	63 346 675 550	64 345 676 549	65 344 677 548	66 343 678 547	67 342 679 546	68 341 680 545	69 340 681 544	70 339 682 543	71 338 683 542	72 337 684 541	73 336 685 540	74 335 686 539	75 334 687 538	76 333 688 537	77 332 689 536	78 331 690 535	79 330 691 534	80 329 692 533	81 328 693 532	82 327 694 531	83 326 695 530	84 325 696 529	85 324 697 528	86 323 698 527	87 322 699 526	88 321 700 525	89 320 701 524	90 319 702 523	91 318 703 522	92 317 704 521	93 316 705 520	94 315 706 519	95 314 707 518	96 313 708 517	97 312 709 516	98 311 710 515	99 310 711 514	100 309 712 513	101 308 713 512	102 307 714 511	103 306 715 510	104 305 716 509	105 304 717 508	106 303 718 507	107 302 719 506	108 301 720 505	109 300 721 504	110 299 722 503	111 298 723 502	112 297 724 501	113 296 725 500	114 295 726 499	115 294 727 498	116 293 728 497	117 292 729 496	118 291 730 495	119 290 731 494	120 289 732 493	121 288 733 492	122 287 734 491	123 286 735 490	124 285 736 489	125 284 737 488	126 283 738 487	127 282 739 486	128 281 740 485	129 280 741 484	130 279 742 483	131 278 743 482	132 277 744 481	133 276 745 480	134 275 746 479	135 274 747 478	136 273 748 477	137 272 749 476	138 271 750 475	139 270 751 474	140 269 752 473	141 268 753 472	142 267 754 471	143 266 755 470	144 265 756 469	145 264 757 468	146 263 758 467	147 262 759 466	148 261 760 465	149 260 761 464	150 259 762 463	151 258 763 462	152 257 764 461	153 256 765 460	154 255 766 459	155 254 767 458	156 253 768 457	157 252 769 456	158 251 770 455	159 250 771 454	160 249 772 453	161 248 773 452	162 247 774 451	163 246 775 450	164 245 776 449	165 244 777 448	166 243 778 447	167 242 779 446	168 241 780 445	169 240 781 444	170 239 782 443	171 238 783 442	172 237 784 441	173 236 785 440	174 235 786 439	175 234 787 438	176 233 788 437	177 232 789 436	178 231 790 435	179 230 791 434	180 229 792 433	181 228 793 432	182 227 794 431	183 226 795 430	184 225 796 429	185 224 797 428	186 223 798 427	187 222 799 426	188 221 800 425	189 220 801 424	190 219 802 423	191 218 803 422	192 217 804 421	193 216 805 420	194 215 806 419	195 214 807 418	196 213 808 417	197 212 809 416	198 211 810 415	199 210 811 414	200 209 812 413	201 208 813 412	202 207 814 411	203 206 815 410	204 205 816 409	205 204 817 408	206 203 818 407	207 202 819 406	208 201 820 405	209 200 821 404	210 199 822 403	211 198 823 402	212 197 824 401	213 196 825 400	214 195 826 399	215 194 827 398	216 193 828 397	217 192 829 396	218 191 830 395	219 190 831 394	220 189 832 393	221 188 833 392	222 187 834 391	223 186 835 390	224 185 836 389	225 184 837 388	226 183 838 387	227 182 839 386	228 181 840 385	229 180 841 384	230 179 842 383	231 178 843 382	232 177 844 381	233 176 845 380	234 175 846 379	235 174 847 378	236 173 848 377	237 172 849 376	238 171 850 375	239 170 851 374	240 169 852 373	241 168 853 372	242 167 854 371	243 166 855 370	244 165 856 369	245 164 857 368	246 163 858 367	247 162 859 366	248 161 860 365	249 160 861 364	250 159 862 363	251 158 863 362	252 157 864 361	253 156 865 360	254 155 866 359	255 154 867 358	256 153 868 357	257 152 869 356	258 151 870 355	259 150 871 354	260 149 872 353	261 148 873 352	262 147 874 351	263 146 875 350	264 145 876 349	265 144 877 348	266 143 878 347	267 142 879 346	268 141 880 345	269 140 881 344	270 139 882 343	271 138 883 342	272 137 884 341	273 136 885 340	274 135 886 339	275 134 887 338	276 133 888 337	277 132 889 336	278 131 890 335	279 130 891 334	280 129 892 333	281 128 893 332	282 127 894 331	283 126 895 330	284 125 896 329	285 124 897 328	286 123 898 327	287 122 899 326	288 121 900 325	289 120 901 324	290 119 902 323	291 118 903 322	292 117 904 321	293 116 905 320	294 115 906 319	295 114 907 318	296 113 908 317	297 112 909 316	298 111 910 315	299 110 911 314	300 109 912 313	301 108 913 312	302 107 914 311	303 106 915 310	304 105 916 309	305 104 917 308	306 103 918 307	307 102 919 306	308 101 920 305	309 100 921 304	310 99 922 303	311 98 923 302	312 97 924 301	313 96 925 300	314 95 926 299	315 94 927 298	316 93 928 297	317 92 929 296	318 91 930 295	319 90 931 294	320 89 932 293	321 88 933 292	322 87 934 291	323 86 935 290	324 85 936 289	325 84 937 288	326 83 938 287	327 82 939 286	328 81 940 285	329 80 941 284	330 79 942 283	331 78 943 282	332 77 944 281	333 76 945 280	334 75 946 279	335 74 947 278	336 73 948 277	337 72 949 276	338 71 950 275	339 70 951 274	340 69 952 273	341 68 953 272	342 67 954 271	343 66 955 270	344 65 956 269	345 64 957 268	346 63 958 267	347 62 959 266	348 61 960 265	349 60 961 264	350 59 962 263	351 58 963 262	352 57 964 261	353 56 965 260	354 55 966 259	355 54 967 258	356 53 968 257	357 52 969 256	358 51 970 255	359 50 971 254	360 49 972 253	361 48 973 252	362 47 974 251	363 46 975 250	364 45 976 249	365 44 977 248	366 43 978 247	367 42 979 246	368 41 980 245	369 40 981 244	370 39 982 243	371 38 983 242	372 37 984 241	373 36 985 240	374 35 986 239	375 34 987 238	376 33 988 237	377 32 989 236	378 31 990 235	379 30 991 234	380 29 992 233	381 28 993 232	382 27 994 231	383 26 995 230	384 25 996 229	385 24 997 228	386 23 998 227	387 22 999 226	388 21 1000 225	389 20 1001 224	390 19 1002 223	391 18 1003 222	392 17 1004 221	393 16 1005 220	394 15 1006 219	395 14 1007 218	396 13 1008 217	397 12 1009 216	398 11 1010 215	399 10 1011 214	400 9 1012 213	401 8 1013 212	402 7 1014 211	403 6 1015 210	404 5 1016 209	405 4 1017 208	406 3 1018 207	407 2 1019 206	408 1 1020 205	409 1021 204	410 1022 203	411 1023 202	412 1024 201	413 1025 200	414 1026 199	415 1027 198	416 1028 197	417 1029 196	418 1030 195	419 1031 194	420 1032 193	421 1033 192	422 1034 191	423 1035 190	424 1036 189	425 1037 188	426 1038 187	427 1039 186	428 1040 185	429 1041 184	430 1042 183	431 1043 182	432 1044 181	433 1045 180	434 1046 179	435 1047 178	436 1048 177	437 1049 176	438 1050 175	439 1051 174	440 1052 173	441 1053 172	442 1054 171	443 1055 170	444 1056 169	445 1057 168	446 1058 167	447 1059 166	448 1060 165	449 1061 164	450 1062 163	451 1063 162	452 1064 161	453 1065 160	454 1066 159	455 1067 158	456 1068 157	457 1069 156	458 1070 155	459 1071 154	460 1072 153	461 1073 152	462 1074 151	463 1075 150	464 1076 149	465 1077 148	466 1078 147	467 1079 146	468 1080 145	469 1081 144	470 1082 143	471 1083 142	472 1084 141	473 1085 140	474 1086 139	475 1087 138	476 1088 137	477 1089 136	478 1090 135	479 1091 134	480 1092 133	481 1093 132	482 1094 131	483 1095 130	484 1096 129	485 1097 128	486 1098 127	487 1099 126	488 1100 125	489 1101 124	490 1102 123	491 1103 122	492 1104 121	493 1105 120	494 1106 119	495 1107 118	496 1108 117	497 1109 116	498 1110 115	499 1111 114	500 1112 113	501 1113 112	502 1114 111	503 1115 110	504 1116 109	505 1117 108	506 1118 107	507 1119 106	508 1120 105	509 1121 104	510 1122 103	511 1123 102	512 1124 101	513 1125 100	514 1126 99	515 1127 98	516 1128 97	517 1129 96	518 1130 95	519 1131 94	520 1132 93	521 1133 92	522 1134 91	523 1135 90	524 1136 89	525 1137 88	526 1138 87	527 1139 86	528 1140 85	529 1141 84	530 1142 83	531 1143 82	532 1144 81	533 1145 80	534 1146 79	535 1147 78	536 1148 77	537 1149 76	538 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