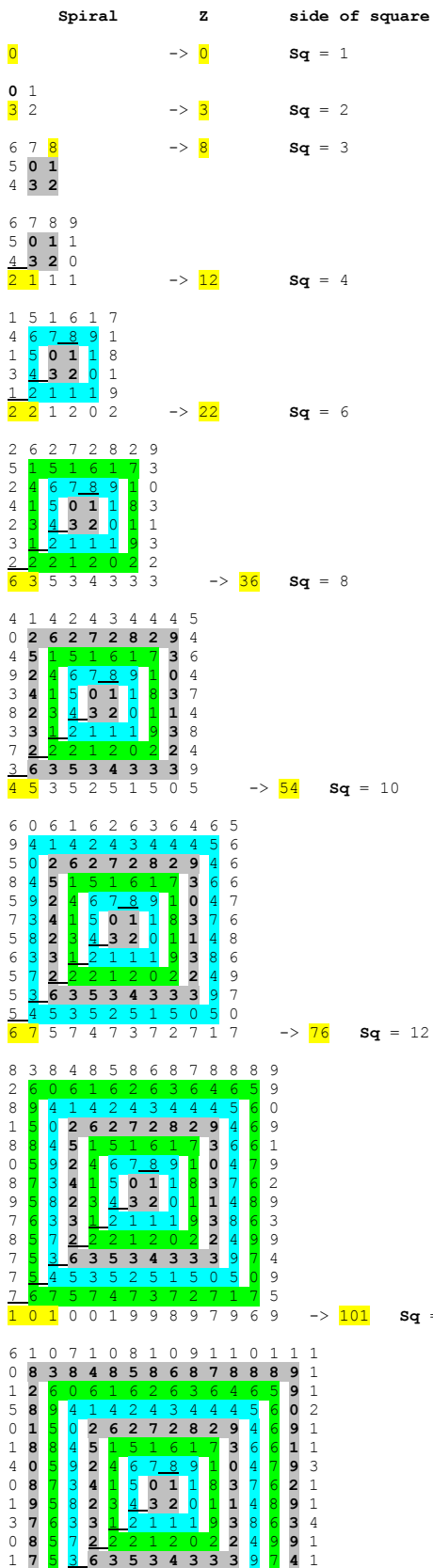
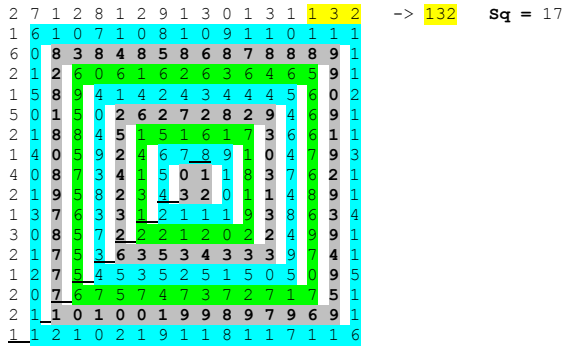
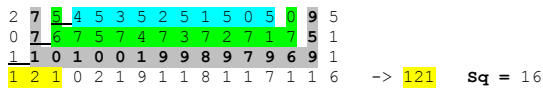


Digit Spiral

Tout a commencé par un message à la liste SeqFans:

- 1) start to write on a grid the nonnegative integers so to form a spiral (one digit clockwise per unit-square);
- 2) make a pause for the last integer fitting perfectly in a [square of unit-squares] and leaving no "hole" (consider both SW et NE corners!) -- else proceed;
- 3) colour this last integer in yellow;
- 4) call **Z** the sequence of yellow terms.





... etc.

Could someone compute more terms? I guess we have for a start $S = 0, 3, 8, 12, 22, 36, 54, 76, 101, 121, 132, \dots$

(hope this is not old hat)

Best,

É.

(yes, I know, I'm colorblind :-)

Jean-Marc Falcoz a dégainé plus vite que son ombre et calculé tous les termes < 10 000 000 :

$Z = 0, 3, 8, 12, 22, 36, 54, 76, 101, 121, 132, 156, 169, 197, 212, 244, 261, 297, 316, 356, 377, 421, 444, 492, 517, 569, 596, 652, 681, 741, 772, 836, 869, 937, 972, 10221, 10626, 11041, 11466, 11901, 12346, 12801, 13266, 13741, 14226, 14721, 15226, 15741, 16266, 16801, 17346, 17901, 18466, 19041, 19626, 20221, 20826, 21441, 22066, 22701, 23346, 24001, 24666, 25341, 26026, 26721, 27426, 28141, 28866, 29601, 30346, 31101, 31866, 32641, 33426, 34221, 35026, 35841, 36666, 37501, 38346, 39201, 40066, 40941, 41826, 42721, 43626, 44541, 45466, 46401, 47346, 48301, 49266, 50241, 51226, 52221, 53226, 54241, 55266, 56301, 57346, 58401, 59466, 60541, 61626, 62721, 63826, 64941, 66066, 67201, 68346, 69501, 70666, 71841, 73026, 74221, 75426, 76641, 77866, 79101, 80346, 81601, 82866, 84141, 85426, 86721, 88026, 89341, 90666, 92001, 93346, 94701, 96066, 97441, 98826, 100184, 101120, 101590, 102534, 103008, 103960, 104438, 105398, 105880, 106848, 107334, 108310, 108800, 109784, 110278, 111270, 111768, 112768, 113270, 114278, 114784, 115800, 116310, 117334, 117848, 118880, 119398, 120438, 120960, 122008, 122534, 123590, 124120, 125184, 125718, 126790, 127328, 128408, 128950, 130038, 130584, 131680, 132230, 133334, 133888, 135000, 135558, 136678, 137240, 138368, 138934, 140070, 140640, 141784, 142358, 143510, 144088, 145248, 145830, 146998, 147584, 148760, 149350, 150534, 151128, 152320, 152918, 154118, 154720, 155928, 156534, 157750, 158360, 159584, 160198, 161430, 162048, 163288, 163910, 165158, 165784, 167040, 167670, 168934, 169568, 170840, 171478, 172758, 173400, 174688, 175334, 176630, 177280, 178584, 179238, 180550, 181208, 182528, 183190, 184518, 185184, 186520, 187190, 188534, 189208, 190560, 191238, 192598, 193280, 194648, 195334, 196710, 197400, 198784, 199478, 200870, 201568, 202968, 203670, 205078, 205784, 207200, 207910, 209334, 210048, 211480, 212198, 213638, 214360, 215808, 216534, 217990, 218720, 220184, 220918, 222390, 223128, 224608, 225350, 226838, 227584, 229080, 229830, 231334, 232088, 233600, 234358, 235878, 236640, 238168, 238934, 240470, 241240, 242784, 243558, 245110, 245888, 247448, 248230, 249798, 250584, 252160, 252950, 254534, 255328, 256920, 257718, 259318, 260120, 261728, 262534, 264150, 264960, 266584, 267398, 269030, 269848, 271488, 272310, 273958, 274784, 276440, 277270, 278934, 279768, 281440, 282278, 283958, 284800, 286488, 287334, 289030, 289880, 291584, 292438, 294150, 295008, 296728, 297590, 299318, 300184, 301920, 302790, 304534, 305408, 307160, 308038, 309798, 310680, 312448, 313334, 315110, 316000, 317784, 318678, 320470, 321368, 323168, 324078, 325878, 326784, 328600, 329510, 331334, 332248, 334080, 334998, 336838, 337760, 339608, 340534, 342390, 343320, 345184, 346118, 347990, 348928, 350808, 351750, 353638, 354584, 356480, 357430, 359334, 360288, 362200, 363158, 365078, 366040, 367968, 368934, 370870, 371840, 373784, 374758, 376710, 377688, 379648, 380630, 382598, 383584, 385560, 386550, 388534, 389528, 391520, 392518, 394518, 395520, 397528, 398534, 400550, 401560, 403584, 404598, 406630, 407648, 409688, 410710, 412758, 413784, 415840, 416870, 418934, 419968, 422040, 423078, 425158, 426200, 428288, 429334, 431430, 432480, 434584, 435638, 437750, 438808, 440928, 441990, 444118, 445184, 447320, 448390, 450534, 451608, 453760, 454838, 456998, 458080, 460248, 461334, 463510, 464600, 466784, 467878, 470070, 471168, 473368, 474470, 476678, 477784, 480000, 481110, 483334, 484448, 486680, 487798, 490038, 491160, 493408, 494534, 496790, 497920, 500184, 501318, 503590, 504728, 507008, 508150, 510438, 511584, 513880, 515030, 517334, 518488, 520800, 521958, 524278, 525440, 527768, 528934, 531270, 532440, 534784, 535958, 538310, 539488, 541848, 543030, 545398, 546584, 548960, 550150, 552534, 553728, 556120, 557318, 559718, 560920, 563328, 564534, 566950, 568160, 570584, 571798, 574230, 575448, 577888, 579110, 581558, 582784, 585240, 586470, 588934, 590168, 592640, 593878, 596358, 597600, 600088, 601334, 603830, 605080, 607584, 608838, 611350, 612608, 615128, 616390, 618918, 620184, 622720, 623990, 626334, 627808, 630360, 631638, 634198, 635480, 638048, 639334, 641910, 643200, 645784, 647078, 649670, 650968, 653568, 654870, 657478, 658784, 661400, 662710, 665334, 666648, 669280, 670598, 673238, 674560, 677208, 678534, 681190, 682520, 685184, 686518, 689190, 690528, 693208, 694550, 697238, 698584, 701280, 702630, 705334, 706688, 709400, 710758, 713478, 714840, 717568, 718934, 721670, 723040, 725784, 727158, 729910, 731288, 734048, 735430, 738198, 739584, 742360, 743750, 746534, 747928, 750720, 752118, 754918, 756320, 759128, 760534, 763350, 764760, 767584, 768998, 771830, 773248, 776088, 777510, 780358, 781784, 784640, 786070, 788934, 790368, 793240, 794678, 797558, 799000, 801888, 803334, 806230, 807680, 810584, 812038, 814950, 816408, 819328, 820790, 823718, 825184, 828120, 829590, 832534, 834008, 836960, 838438, 841398, 842880, 845848, 847334, 850310, 851800, 854784, 856278, 859270, 860768, 863768, 865270, 868278, 869784, 872800, 874310, 877334, 878848, 881880, 883398, 886438, 887960, 891008, 892534, 895590, 897120, 900184, 901718, 904790, 906328, 909408, 910950, 914038, 915584, 918680, 920230, 923334, 924888, 928000, 929558, 932678, 934240, 937368, 938934, 942070, 943640, 946784, 948358, 951510, 953088, 956248, 957830, 960998, 962584, 965780, 967350, 970534, 972128, 975320, 976910, 980118, 981720, 984928, 986534, 989750, 991360, 994584, 996198, 999430, 1001592, 1006457, 1011336, 1016229, 1021136, 1026057, 1030992, 1035941, 1040904, 1045881, 1050872, 1055877, 1060896, 1065929, 1070976, 1076037, 1081112, 1086201, 1091304, 1096421, 1101552, 1106697, 1111856, 1117029, 1122216, 1127417, 1132632, 1137861, 1143104, 1148361, 1153632, 1158917, 1164216, 1169529, 1174856, 1180197, 1185552, 1190921, 1196304, 1201701, 1207112, 1212537, 1217976, 1223429, 1228896, 1234377, 1239872, 1245381, 1250904, 1256441, 1261992, 1267557, 1273136, 1278729, 1284336, 1289957, 1295592, 1301241, 1306904, 1312581, 1318272, 1323977, 1329696, 1335429, 1341176, 1346937, 1352712, 1358501, 1364304, 1370121, 1375952, 1381797, 1387656, 1393529, 1399416, 1405317, 1411232, 1417161, 1423104, 1429061, 1435032, 1441017, 1447016, 1453029, 1459056, 1465097, 1471152, 1477221, 1483304, 1489401, 1495512, 1501637, 1507776, 1513929, 1520096, 1526277, 1532472, 1538681, 1544904, 1551141, 1557392, 1563657, 1569936, 1576229, 1582536, 1588857, 1595192, 1601541, 1607904, 1614281, 1620672, 1627077, 1633496, 1639929, 1646376, 1652837, 1659312, 1665801, 1672304, 1678821, 1685352, 1691897, 1698456, 1705029, 1711616, 1718217, 1724832, 1731461, 1738104, 1744761, 1751432, 1758117, 1764816, 1771529, 1778256, 1784997, 1791752, 1798521, 1805304, 1812101, 1818912, 1825737, 1832576, 1839429, 1846296, 1853177, 1860072, 1866981, 1873904, 1880841, 1887792, 1894757, 1901736, 1908729, 1915736, 1922757, 1929792, 1936841, 1943904, 1950981, 1958072, 1965177, 1972296, 1979429, 1986576, 1993737, 2000912, 2008101, 2015304, 2022521, 2029752, 2036997, 2044256, 2051529, 2058816, 2066117, 2073432, 2080761, 2088104, 2095461, 2102832, 2110217, 2117616, 2125029, 2132456, 2139897, 2147352, 2154821, 2162304, 2169801, 2177312, 2184837, 2192376, 2199929, 2207496, 2215077, 2222672, 2230281, 2237904, 2245541, 2253192, 2260857, 2268536, 2276229, 2283936, 2291657, 2299392, 2307141, 2314904, 2322681, 2330472, 2338277, 2346096, 2353929, 2361776, 2369637, 2377541, 2385401, 2393304, 2401221, 2409152, 2417097, 2425056, 2433029, 2441016, 2449017, 2457032, 2465061, 2473104, 2481161, 2489232, 2497317, 2505416,$

Table of numbers from 2513529 to 9938597, arranged in a spiral pattern.

Jean-Marc a calculé aussi une deuxième suite ; celle composée des côtés des carrés « remplis exactement ».

« Le premier nombre est le terme de la suite [ci-dessus], le second est la taille du côté du carré au coin duquel il se trouve » :

- List of coordinate pairs (x,y) representing the corners of squares in a spiral, starting from (0,1) and ending at (46460, 1636).

Suite **Pr_{côté}** des côtés des carrés remplis exactement par les chiffres des nombres premiers ci-dessus :

Pr_{côté} = 1, 2, 4, 6, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 117, 127, 131, 137, 139, 149, 151, 157, 163, 167, 173, 179, 181, 187, 191, 193, 197, 199, 209, 211, 223, 227, 229, 233, 239, 241, 251, 257, 263, 269, 271, 277, 281, 283, 293, 307, 311, 313, 317, 331, 337, 347, 349, 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 419, 421, 431, 433, 439, 443, 449, 457, 461, 463, 467, 479, 487, 491, 499, 503, 509, 521, 523, 541, 547, 557, 563, 569, 577, 587, 599, 601, 607, 613, 617, 619, 623, 629, 631, 637, 641, 643, 647, 653, 659, 661, 667, 673, 677, 683, 689, 691, 697, 701, 709, 719, 727, 733, 739, 743, 751, 757, 761, 769, 773, 787, 797, 809, 811, 817, 821, 823, 827, 829, 833, 839, 843, 853, 857, 859, 863, 869, 877, 881, 883, 887, 893, 907, 911, 919, 929, 937, 941, 947, 953, 967, 971, 977, 983, 991, 1009, 1013, 1019, 1021, 1031, 1033, 1039, 1043, 1051, 1057, 1063, 1069, 1073, 1079, 1087, 1093, 1099, 1103, 1109, 1117, 1123, 1129, 1133, 1139, 1147, 1151, 1157, 1163, 1169, 1177, 1181, 1183, 1187, 1193, 1197, 1204, 1211, 1217, 1223, 1229, 1231, 1237, 1241, 1247, 1253, 1259, 1267, 1271, 1277, 1283, 1289, 1291, 1297, 1301, 1303, 1307, 1311, 1313, 1317, 1321, 1327, 1331, 1337, 1343, 1349, 1351, 1357, 1361, 1367, 1371, 1379, 1381, 1387, 1391, 1403, 1407, 1411, 1417, 1421, 1423, 1429, 1433, 1439, 1441, 1447, 1451, 1453, 1459, 1463, 1469, 1471, 1477, 1481, 1483, 1489, 1493, 1499, 1501, 1507, 1511, 1517, 1523, 1529, 1531, 1543, 1547, 1549, 1553, 1559, 1561, 1567, 1571, 1573, 1577, 1581, 1583, 1589, 1591, 1597, 1601, 1603, 1607, 1609, 1613, 1617, 1621, 1623, 1627, 1631, 1633, 1637, 1641, 1643, 1649, 1651, 1653, 1657, 1659, 1663, 1667, 1669, 1671, 1673, 1677, 1681, 1683, 1687, 1689, 1691, ...

Faisons de même avec les nombre de Fibonacci (attention, c'est du brutal !) :

Spirale	Suite Fi	Côté du carré « plein » = suite Fi_{côté}
0	-> 0	1
0 1		
2 1	-> 2	2
8 1 3	-> 13	3
5 0 1		
3 2 1		
2 3 3 3 7 7		
4 8 1 3 2 6		
4 5 0 1 1 1		
1 3 2 1 3 0		
9 8 5 5 4 9		
7 9 5 1 7 8	-> 1597	6
...

Fi = 0, 2, 13, 1597, 1134903170, 3416454622906707, 10284720757613717413913, 394810887814999156320699623170776339, 14153075162206073478934963754161180690656058181482565606505778265589725431805766214234113531484476942290390586786387713924668188609735 50735565489499797512576144344242780042620227238147640546853218443231457841287797456600083212822748558767337492604319704628923840439204 9753147955518716756122347117721791647487337999664468768608474182968923117929428319845226097298611988637207640691985787658529650837075 7142168961210661162436558623109220850442785675017083549650127758724322208781520695398688030424423593529403543887536227765191182950894 73626311211801038328906538580609435329434446786687710690108940619777435898732415623878950251392175415848469466891763154596310144848316 16985109314043401950926471995943057849044489177587715882320161285477223191628981254372067021335091654527759721469192728695213482633615 70881045232193538729794933190571140151064184469511489417754968982815468253101442083244438690899140624388958693873274575489543096608917 3918353828430878669938381897144911508942505977321724980361825628351843402235140546687254617957517327152689959499050583477924142504987 43251461002515848423998894333799664165304902868102657113084389646761991617194889748982408496623954657603433068352280040143958478436022 55158141350335096177788867714400331092852154117460598886769415456372481206058293044337333595089201275667710401918150889018103365528176 ...

Suite **Fi_{côté}** des côtés des carrés remplis exactement par les chiffres des nombres de Fibonacci ci-dessus :

Fi_{côté} = 1, 2, 3, 6, 15, 25, 35, 56, 227, 398, 847, 986, 1713, 4589, 6460, 7465, 24860, 28741, ...

Au lieu de semer les chiffres des « nonnegative integers » (soit l'ensemble Z+ des nombres entiers), on aurait pu disposer de même les chiffres des **carrés** parfaits. Une sorte de mise en abyme : des carrés semés dans des carrés ! Plus besoin de « spiraler », il suffit de remplir successivement les bordures **est** et **sud** du carré qui précède, en commençant avec un carré unité. On obtient :

Côté du carré : 1 2 4 5 7 8 ...

0	1	1	6	1	1	6	4	1	6	9
4	9	16	4	10	16	2	4	17	1	6
2	5	3	9	10	19	8	1	16	0	.
6	4	8	1	1	1	9	4	17	2	E
2	1	1	4	4	19	3	8	2	4	S
6	2	2	5	2	5	2	4	19	1	T
4	3	6	1	4	0	0	5	17	0	
2	9	5	7	6	6	2	5	18	8	
4	8	4	1	9	0	0	9	6	9	
1	1	5	6	1	2	2	5	1	2	

S U D

Cabyrne = 0, 9, 81, 144, 400, 625, ... (le dernier chiffre d'un nombre jaune - ici en gras - est sur la diagonale descendante \ du carré).

CoCabyrne = 1, 2, 4, 5, 7, 8, ... (numéro des colonnes comportant un chiffre gras ou côté du carré)

Jean-Marc a calculé ces deux suites (ainsi que toutes celles plus bas) :

Cabyrne = 0, 9, 81, 144, 400, 625, 15625, 17956, 30276, 34225, 54289, 60516, 91204, 1113025, 1478656, 1934881, 2496400, 3179089, 4000000, 4977361, 6130576, 7480225, 9048064, 1009205824, 1063281664, 1077152400, 1134072976, 1148667664, 1208535696, 1223880256, 1286800384, 1302921216, 1369000000, 1385923984, 1455269904, 1473024400, 1545747856, 1564360704, 1640574016, 1660073536, 1739890944, 1760305936, 1843843600, 1865203344, 1952579344, 1974913600, 2066247936, 2089586944, 2185001536, 2209376016, 2308994704, 2334435856, 2438384400, 2464923904, ...

CoCabyrne = 1, 2, 4, 5, 7, 8, 22, 23, 27, 28, 32, 33, 37, 77, 84, 91, 98, 105, 112, 119, 126, 133, 140, 521, 529, 531, 539, 541, 549, 551, 559, 561, 569, 571, 579, 581, 589, 591, 599, 601, 609, 611, 619, 621, 629, 631, 639, 641, 649, 651, 659, 661, 669, 671, ...

Notons que le remplissage par bordures est et sud est équivalent au remplissage d'un escalier où les marches s'allongent de deux unités à chaque fois :

*
* * *
* * * * *
* * * * * *
* * * * * * *
* * * * * * * *
* * * * * * * * * <-- deux unités (deux cases) supplémentaires pour chaque marche
...

On remplit ainsi (on sème la succession des chiffres des carrés parfaits dans chaque case et on garde les nombres « qui tombent juste » en bout de marche) :

0
1, 4, 9
1 6, 2 5, 3
6, 4 9, 6 4, 8 1
1 0 0, 1 2 1, 1 4 4
1 6 9, 1 9 6, 2 2 5, 2 5
6, 2 8 9, 3 2 4, 3 6 1, 4 0 0
4 4 1, 4 8 4, 5 2 9, 5 7 6, 6 2 5
...

Tant qu'à jouer la mise en abyme, disposons en triangle les chiffres des nombres triangulaires - et conservons ceux « qui tombent juste » (ils forment la suite Triabyrne) ; les marches de l'escalier grandissent ici d'une unité à chaque fois (la suite LiTriabyrne reprend les numéros des lignes du triangle comportant un nombre en jaune) :

0
1, 3
6, 1 0
1 5, 2 1
2 8, 3 6, 4
5, 5 5, 6 6, 7
8, 9 1, 1 0 5, 1
2 0, 1 3 6, 1 5 3
1 7 1, 1 9 0, 2 1 0
2 3 1, 2 5 3, 2 7 6, 3
0 0, 3 2 5, 3 5 1, 3 7 8
4 0 6, 4 3 5, 4 6 5, 4 9 6
5 2 8, 5 6 1, 5 9 5, 6 3 0, 6
6 6, 7 0 3, 7 4 1, 7 8 0, 8 2 0
8 6 1, 9 0 3, 9 4 6, 9 9 0, 1 0 3
5, 1 0 8 1, 1 1 2 8, 1 1 7 6, 1 2 2
5, 1 2 7 5, 1 3 2 6, 1 3 7 8, 1 4 3 1
...

Triabyrne = 0, 3, 10, 21, 153, 210, 378, 496, 820, 1431, 3081, 4656, 8646, 11628, 15051, 17766, 22578, 26335, 32896, 37950, 46665, 53301, 64620, 73153, 87571, 98346, 108345, 113526, 130305, 162735, 185136, 193131, 218791, 267546, 300700, 312445, 349866, 419986, 467061, 483636, 536130, 633375, 697971, 720600, 791911, 922761, 1007490, 1033203, 1198926, 1228528, 1418770, 1452660, 1669878, 1708476, 1955253, 1999000, 2278045, 2327403, 2641551, 2697003, 3049215, 3111265, 3504628, 3573801, 4011528, 4088370, 4573800, 4658878, 5195476, 5289378, 5880735, 5984070, 6633903, 6747301, 7459453, 7583565, 8362005, 8497503, 9346326, 9493903, 10504236, 11226691, 12956595, 13810140, 15845635, 16846110, 19223100, 20387305, 23143806, 24489501, 27665641, 29211546, 32849565, 34615360, 38759610, 40765935, 45462880, 47731335, ...

LiTriabyrne = 1, 2, 3, 4, 8, 9, 11, 12, 14, 17, 22, 25, 30, 33, 36, 38, 41, 43, 46, 48, 51, 53, 56, 58, 61, 63, 65, 66, 69, 74, 77, 78, 81, 86, 89, 90, 93, 98, 101, 102, 105, 110, 113, 114, 117, 122, 125, 126, 132, 133, 139, 140, 146, 147, 153, 154, 160, 161, 167, 168, 174, 175, 181, 182, 188, 189, 195, 196, 202, 203, 209, 210, 216, 217, 223, 224, 230, 231, 237, 238, 245, 250, 261, 266, 277, 282, 293, 298, 309, 314, 325, 330, 341, 346, 357, 362, 373, 378, ...

Mise en abyme des nombres pentagonaux - on sème les chiffres des pentagonaux sur les marches de l'escalier suivant :

*
* * *
* * * * *
* * * * * *
* * * * * * *
* * * * * * * * <-- la marche s'allonge de trois cases à chaque fois

Pabyrne = 0, 12, 590, 1001, 5551, 11837, 17442, 29751, 41251, 64792, 85562, 109215, 264390, 343922, 699392, 866020, 1114135, 1316485, 1631252, 1904630, 2324415, 2684697, 3231802, 3696565, 4395560, 4984082, 5861805, 6595065, 7680622, 8581300, 9906065, 12622251, 15444917, 19785320, 23782495, 29821792, 35295876, 43446195, 50735876, 61456001, 70936255, 84731626, 96813717, 103804482, 120068740, 138292805, 158635842, 181263577, 206348297, 234068850, 264610645, 298165652, 334932402, 375115987, 418928060, 466586835, 518317087, 574350152, 634923927, 700282870, 770678000, 846366897, 927613702, ...

LiPabyrne = 1, 2, 6, 7, 12, 15, 17, 20, 22, 25, 27, 29, 38, 41, 50, 53, 57, 60, 64, 67, 71, 74, 78, 81, 85, 88, 92, 95, 99, 102, 106, 114, 121, 130, 137, 146, 153, 162, 169, 178, 185, 194, 201, 205, 214, 223, 232, 241, 250, 259, 268, 277, 286, 295, 304, 313, 322, 331, 340, 349, 358, 367, 376, ...

Mise en abyme des [nombres hexagonaux](#) – on sème les chiffres des hexagonaux sur les marches de l’escalier suivant :

```
*
* * * * *
* * * * * * * * *
* * * * * * * * * *
* * * * * * * * * * * * * * * < -- la marche s’allonge de quatre cases à chaque fois
```

H_{abyme} = 0, 276, 1128, 5995, 14365, 22791, 42486, 61776, 132870, 271953, 507528, 878475, 1558495, 2418900, 3616705, 5234230, 7363203, 11729746, 15643621, 20528028, 26539255, 33845878, 42628761, 53081056, 65408203, 79827930, 96570253, 1112952610, 1238501565, 1374950580, 1522940455, 1683131190, 1856201985, 2042851240, 2243796555, 2459774730, 2691541765, 2939872860, 3205562415, 3489424030, 3792290505, 4115013840, 4458465235, 4823535090, ...

LiH_{abyme} = 1, 4, 6, 10, 13, 15, 18, 20, 25, 31, 37, 43, 51, 58, 65, 72, 79, 90, 98, 106, 114, 122, 130, 138, 146, 154, 162, 319, 329, 339, 349, 359, 369, 379, 389, 399, 409, 419, 429, 439, 449, 459, 469, 479, ...

Mise en abyme des [nombres heptagonaux](#) (même technique de semis que supra) :

7_{abyme} = 0, 34, 1782, 7209, 10465, 39501, 109935, 172528, 338008, 485541, 544522, 755425, 11116539, 11617606, 21545836, 22390633, 38468938, 39794265, 64254645, 66221302, 1031108239, 1247990608, 1327760721, 1591344405, 1687751748, 2004588747, 2119892320, 2496984634, 2633593437, 3078393066, 3238866099, 3759275043, 3946321306, 4550691565, 4767170058, 5464303632, 5713223355, ...

Li7_{abyme} = 1, 2, 6, 9, 10, 15, 20, 23, 28, 31, 32, 35, 75, 76, 91, 92, 107, 108, 123, 124, 264, 279, 284, 299, 304, 319, 324, 339, 344, 359, 364, 379, 384, 399, 404, 419, 424, ...

Mise en abyme des [nombres octogonaux](#) (ce lien montre en outre une spirale hexagonale générant tous les hexagonaux) :

8_{abyme} = 0, 100101, 271201, 620165, 1100496, 1735841, 2060065, 3082560, 3588320, 5137825, 5885601, 8124656, 9184000, 118528816, 150067841, 187878360, 232777825, 285636176, 347375841, 418971736, 501451265, 595894320, 703433281, 825253016, 962590881, ...

K8_{abyme} = 1, 17, 23, 29, 34, 39, 41, 46, 48, 53, 55, 60, 62, 127, 136, 145, 154, 163, 172, 181, 190, 199, 208, 217, 226, ...

Mise en abyme des [nombres ennéagonaux](#) :

9_{abyme} = 0, 75, 325, 10836, 42075, 56134, 344301, 545100, 1449966, 2813889, 5028606, 8404875, 13592016, 19653225, 30368841, 41481264, 60123225, 78624750, ...

Li9_{abyme} = 1, 2, 3, 8, 12, 13, 22, 25, 33, 40, 47, 54, 62, 69, 78, 85, 94, 101, ...

Mise en abyme des [nombres décagonaux](#) :

10_{abyme} = 0, 85, 9457, 1636480, 3331537, 6166530, 15188557, 23846130, 35967007, 52406740, 74119185, 101914072, 120675717, 137575305, 161270950, 182445802, 211913527, 238061755, 274208760, 306083772, 349886377, 388296877, 440800522, 486610510, 548929755, 603058527, 676377052, 739799200, 825369805, 899115217, 998259822, ...

Li10_{abyme} = 1, 2, 7, 31, 38, 45, 58, 66, 74, 82, 90, 98, 103, 107, 112, 116, 121, 125, 130, 134, 139, 143, 148, 152, 157, 161, 166, 170, 175, 179, 184, ...

Que pourrait être, sur ce modèle, une mise en abyme des [nombres premiers](#) ? Il faut d’abord fabriquer l’« escalier » qui leur correspond.

Comme pour les « escaliers » vus jusqu’ici (où chaque marche se terminait par un nombre triangulaire, carré, pentagonal, etc.), l’« escalier des premiers » voit chacune de ses marches se terminer par un premier. La « forme première » en résulte et le semis peut commencer :

Escalier des premiers	Forme première	Semis
00 01 <u>02</u> (3 nombres)	* * * (3 cases)	2,3, 5 (3 chiffres)
<u>03</u> (1 nombre)	* (1 case)	7 (1 chiffre)
04 <u>05</u> (2 nombres)	* * (2 cases)	1 1 (2 chiffres)
06 <u>07</u> ...	* * ...	1 3
08 09 10 <u>11</u>	* * * *	1 7, 1 9
12 <u>13</u>	* *	2 3
14 15 16 <u>17</u>	* * * *	2 9, 3 1
18 <u>19</u>	* *	3 7
20 21 22 <u>23</u>	* * * *	4 1, 4 3
24 25 26 27 28 <u>29</u>	* * * * *	4 7,5 3, 5 9
30 <u>31</u>	* *	6 1
32 33 34 35 36 <u>37</u>	* * * * * *	6 7,7 1, 7 3
38 39 40 <u>41</u>	* * * *	7 9, 8 3
42 <u>43</u>	* *	8 9
44 45 46 <u>47</u>	* * * *	9 7,1 0
48 49 50 51 52 <u>53</u>	* * * * * *	1,1 0 3,1 0
54 55 56 57 58 <u>59</u>	* * * * * *	7,1 0 9,1 1
60 <u>61</u>	* *	3,1
62 63 64 65 66 <u>67</u>	* * * * * *	2 7,1 3 1,1
68 69 70 <u>71</u>	* * * *	3 7,1 3
72 <u>73</u>	* *	9,1
74 75 76 77 78 <u>79</u>	* * * * * *	4 9, 1 5 1,1
80 81 82 <u>83</u>	* * * *	5 7,1 6
84 85 86 87 88 <u>89</u>	* * * * * *	3,1 6 7,1 7
90 91 92 93 94 95 96 <u>97</u>	* * * * * * *	3,1 8 1,1 9 1,1
...

La suite **Pr_{abyme}** des premiers qui « tombent juste » (même après enjambement) est composée des nombres en jaune ci-dessus ; la suite **LiPr_{abyme}** est celle des numéros de ligne où apparaissent un à un ces nombres :

Pr_{abyme} = 5, 7, 11, 13, 19, 23, 31, 37, 43, 59, 61, 73, 83, 89, 10007, 10037, 10111, 10139, 10163, 10321, 10369, 10399,

3378, 3384, 3391, 3395, 3398, 3399, 3403, 3406, 3411, 3418, 3424, 3425, 3429, 3430, 3433, 3440, 3443, 3449, 3451, 3452, 3455, 3456, 3457, 3464, 3467, 3470, 3472, 3479, 3480, 3483, 3488, 3491, 3494, 3496, 3499, 3503, 3505, 3507, 3509, 3515, 3519, 3521, 3523, 3529, 3535, 3537, 3539, 3540, 3544, 3546, 3547, 3550, 3559, 3561, 3570, 3573, 3577, 3579, 3586, 3587, 3590, 3592, 3600, 3603, 3609, 3610, 3618, 3627, 3630, 3632, 3641, 3645, 3653, 3655, 3658, 3662, 3663, 3666, 3667, 3676, 3683, 3688, 3691, 3693, 3696, 3698, 3703, 3706, 3707, 3714, 3719, 3724, 3726, 3731, 3733, 3736, 3740, 3749, 3763, 3766, 3767, 3769, 3773, 3784, 3786, 3788, 3790, 3792, 3799, 3804, 3810, 3816, 3817, 3819, 3822, 3823, 3827, 3832, 3833, 3848, 3851, 3854, 3857, 3858, 3859, 3860, 3862, 3867, 3869, 3871, 3877, 3879, 3885, 3886, 3889, 3893, 3903, 3906, 3914, 3916, 3919, 3921, 3924, 3925, 3935, 3944, 3945, 3946, 3947, 3951, 3957, 3962, 3965, 3966, 3968, 3980, 3986, 3987, 3990, 3992, 3997, 4000, 4003, 4012, 4016, 4021, 4023, 4024, 4027, 4030, 4039, 4043, 4048, 4052, 4056, 4060, 4065, 4066, 4072, 4076, 4080, 4081, 4087, 4089, 4091, 4096, 4098, 4101, 4102, 4103, 4107, 4109, 4111, 4116, 4118, 4120, 4124, 4132, 4136, 4138, 4140, 4142, 4146, 4147, 4152, 4156, 4162, 4167, 4173, 4177, 4191, 4194, 4199, 4202, 4205, 4209, 4211, 4214, 4218, 4219, 4223, 4224, 4228, 4230, 4232, 4237, 4240, 4243, 4245, 4251, 4254, 4261, 4268, 4272, 4274, 4279, 4282, 4284, 4286, 4290, 4291, 4294, 4301, 4305, 4310, 4313, 4314, 4318, 4319, 4321, 4325, 4334, 4335, 4336, 4341, 4345, 4348, 4350, 4372, 4373, 4376, 4379, 4381, 4386, 4391, 4393, 4396, 4397, 4400, 4401, 4411, 4415, 4420, 4421, 4424, 4429, 4433, 4436, 4438, 4442, 4444, 4449, 4457, 4461, 4465, 4470, 4473, 4475, 4481, 4483, 4486, 4489, 4490, 4495, 4496, 4501, 4503, 4504, 4506, 4513, 4517, 4519, 4526, 4537, 4538, 4545, 4547, 4556, 4560, 4563, 4565, 4569, 4570, 4571, 4574, 4576, 4585, 4593, 4601, 4606, 4609, 4612, 4617, 4621, 4622, 4629, 4631, 4633, 4638, 4639, 4644, 4651, 4653, 4660, 4665, 4670, 4672, 4674, 4677, 4678, 4681, 4693, 4696, 4699, 4706, 4710, 4711, 4713, 4718, 4719, 4720, 4722, 4728, 4733, 4741, 4746, 4748, 4750, 4751, 4754, 4755, 4757, 4767, 4769, 4771, 4772, 4775, 4778, 4786, 4809, ...

Une mise en abyme équivalente des [nombres de Fibonacci](#) ne produit pas grande chose, comme l'a vérifié **Jean-Marc Falcoz** :
« Jusqu'à F30000, les seuls nombres qui marchent sont 1, 1, 2, 5, 13 » :

Fiabyme = 1, 1, 2, 5, 13, ...

LiFiabyme = 1, 2, 3, 4, 5, ...

Merci à tous !

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