

Three-term arithmetic progressions, including at least two primes of the intervals $[n^2, (n+1)^2]$

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For all non zero natural integer n , the interval $[n^2, (n+1)^2]$ of N^* , contains at least one three – term arithmetic progression, including at least two primes and which arithmetic mean is either $n^2 + n - 1$, $n^2 + n$, or $n^2 + n + 1$.

Abstract- My conjecture is based on the table presented in the paper as follows: For all non zero natural integer n

- 1) the primes and the arithmetic progressions of three terms including at least two primes and which arithmetic means are either $n^2 + n - 1$, $n^2 + n$, or $n^2 + n + 1$
- 2) the progressions are of three types:
Type A: for progressions which arithmetic means are of the form: $n^2 + n - 1$
Type B: for progressions which arithmetic means are of the form: $n^2 + n$
Type C: for progressions which arithmetic means are of the form: $n^2 + n + 1$

Index Terms- Three term arithmetic progression – primes – arithmetic mean – interval $[n^2, (n+1)^2]$ – conjecture – at least-table.

Note that :

- 1) all arithmetic means are printed in red.
- 2) the progressions which all three terms are primes are printed into the green cells of the table.

REFERENCES

- [1] http://compoasso.free.fr/primelistweb/page/prime/liste_online.php liste des nombres premiers jusqu'à: 1000000000000

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I. INTRODUCTION

The French mathematician Adrien Marie Legendre (1752 – 1833) stated in his conjecture:

For any non zero natural integer n , between n^2 and $(n+1)^2$ there exists at least one prime number.

This encourages me to better study the repartition of primes within the intervals $[n^2, (n+1)^2]$ of N^*

I chose the first 100 intervals and found out that each one contains at least one three term arithmetic progression including at least two primes and which arithmetic mean is either $n^2 + n - 1$, $n^2 + n$ or $n^2 + n + 1$.

ForeWord

I'm very pleased and proud to contribute to enriching the bibliography of number theory topics. Hope that this conjecture would be taken into consideration by a large number of number theorists in order to prove the veracity of its content, for all non zero natural integers.

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Table of the primes and arithmetic three term progressions of the 100 first intervals $[n^2, (n+1)^2[$ of N^*

n	The interval $[n^2, (n+1)^2[$ of N^*	The interval's primes	The interval's primes' number	examples of arithmetic three term progressions	Progressions common difference	progression's type
1	[1 , 4[	2,3	2	{1,2,3}	1	B
2	[4 , 9[	5,7	2	{5,6,7}	1	B
3	[9 , 16[	11,13	2	{11,12,13}	1	B
4	[16 , 25[	17,19,23	3	{17,20,23}	3	B
				{19,21,23}	2	C
5	[25 , 36[	29,31	2	{29,30,31}	1	B
6	[36 , 49[	37,41,43,47	4	{37,42,47}	5	B
				{41,42,43}	1	B
7	[49 , 64[	53,59,61	3	{53,56,59}	3	B
				{53,57,61}	4	C
8	[64 , 81[	67,71,73,79	4	{71,72,73}	1	B
				{67,73,79}	6	C
9	[81 , 100[	83,89,91,97	4	{83,90,97}	7	B
10	[100 , 121[	101,103,107,109,113	5	{103,111,119}	8	C
				{107,110,113}	3	B
11	[121 , 144[	127,131,133,137,139	5	{127,132,137}	5	B
				{131,132,133}	1	B
12	[144 , 169[	149,151,157,163,167	5	{149,156,163}	7	B
				{151,157,163}	6	C
13	[169 , 196[	173,179,181,191,193	5	{173,182,191}	9	B
				{173,183,193}	10	C
14	[196 , 225[	197,199,211,223	4	{197,210,223}	13	B
				{199,211,223}	12	C
15	[225 , 256[	227,229,233,239,241,251	6	{229,240,251}	11	B
				{233,241,249}	8	C
16	[256 , 289[	257,263,267,269,271,277,281,283	8	{263,272,281}	9	B
				{267,272,277}	5	B
17	[289 , 324[	293,307,311,313,317	5	{293,305,317}	12	A

18	[324 , 361[	331,337,347,349,353,359	6	{331,342,353}	11	B
				{341,342,343}	1	B
				{337,343,349}	6	C
19	[361 , 400[	367,373,379,383,389,397	6	{373,381,389}	8	C
				{379,381,383}	2	C
20	[400 , 441[	401,409,419,421,431,433,439	7	{401,420,439}	19	B
				{409,421,433}	12	C
21	[441 , 484[	443,449,457,461,463,467,479	7	{457,462,467}	5	B
				{461,462,463}	1	B
				{443,461,479}	18	A
22	[484 , 529[	487,491,499,503,509,521,523	7	{491,506,521}	15	B
				{503,506,509}	3	B
				{487,505,523}	18	A
23	[529 , 576[	541,547,557,563,569,571	6	{547,552,557}	5	B
				{541,552,563}	11	B
24	[576 , 625[	577,587,593,599,601,607, 613,617,619	9	{587,600,613}	13	B
				{593,600,607}	7	B
				{599,600,601}	1	B
25	[625 , 676[	631,641,643,647,653, 659,661,673	8	{641,650,659}	9	B
				{647,650,653}	3	B
				{643,651,659}	8	C
26	[676 , 729 [	677,683,691,701,709,719,727	7	{677,702,727}	25	B
				{683,701,719}	18	A
27	[729 , 784 [	733,739,743,751,757, 761,769,773	8	{739,756,773}	17	B
				{743,756,769}	13	B
				{751,756,761}	5	B
28	[784 , 841[	787,797,809,811,821, 823,827,829,839	9	{797,812,827}	15	B
				{787,813,839}	26	C
				{797,813,829}	16	C
29	[841 , 900[853,857,859,863,877, 881,883,887	8	{853,870,887}	17	B
				{859,870,881}	11	B
				{859,871,883}	12	C

			{857,869,881}	12	A
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30	[900 , 961[907,911,919,929,937, 941,947,953	8	{907,930,953}	23	B
				{919,930,941}	11	B
				{911,929,947}	18	A
31	[961 , 1024[	967,971,977,983,991,997, 1009,1013,1019,1021	10	{971,992,1013}	21	B
				{967,993,1019}	26	C
				{977,993,1009}	16	C
32	[1024,1089[	1031,1033,1039,1049,1051, 1061,1063,1069,1087	9	{1049,1056,1063}	7	B
				{1051,1056,1061}	5	B
				{1051,1057,1063}	6	C
33	[1089,1156[	1091,1093,1097,1103,1109, 1117,1123,1129,1151,1153	10	{1091,1122,1153}	31	B
				{1093,1122,1151}	29	B
				{1091,1121,1151}	30	A
				{1093,1123,1153}	30	C
34	[1156,1225[	1163,1171,1181,1187,1193, 1201,1213,1217,1223	9	{1163,1190,1217}	27	B
				{1187,1190,1193}	3	B
				{1181,1191,1201}	10	C
35	[1225,1296[	1229,1231,1237,1249,1259, 1277,1279,1283,1289,1291	10	{1229,1260,1291}	31	B
				{1231,1260,1289}	29	B
				{1231,1261,1291}	30	C
				{1229,1259,1289}	30	A
				{1237,1260,1283}	23	B
36	[1296,1369[	1297,1301,1303,1307,1319, 1321,1327,1361,1367	9	{1297,1332,1367}	35	B
				{1303,1332,1361}	29	B
				{1301,1331,1361}	30	A
37	[1369,1444[	1373,1381,1399,1409,1423, 1427,1429,1433,1439	9	{1373,1406,1439}	33	B
				{1381,1405,1429}	24	A
				{1381,1407,1433}	26	C
38	[1444,1521[	1447,1451,1453,1459,1471, 1481,1483,1487,1489, 1493,1499,1511	12	{1451,1481,1511}	30	A
				{1471,1482,1493}	11	B
				{1481,1482,1483}	1	B
39	[1521,1600[	1523,1531,1543,1549,1553, 1559,1567,1571,1579,	11	{1523,1560,1597}	37	B
				{1549,1560,1571}	11	B

		1583,1597		{1553,1560,1567}	7	B
				{1543,1561,1579}	18	C
40	[1600,1681[	1601,1607,1609,1613,1619, 1621,1627,1637,1657, 1663,1667,1669	12	{1609,1639,1669}	30	A
				{1613,1640,1667}	27	B
				{1619,1641,1663}	22	C
				{1621,1639,1657}	18	A
41	[1681,1764[	1693,1697,1699,1709,1721, 1723,1733,1741,1747, 1753,1759	11	{1693,1723,1753}	30	C
				{1699,1723,1747}	24	C
				{1721,1722,1723}	1	B
42	[1764,1849[	1777,1783,1787,1789,1801, 1811,1823,1831,1847	9	{1783,1807,1831}	24	C
				{1801,1806,1811}	5	B
43	[1849,1936[	1861,1867,1871,1873,1877, 1879,1889,1901,1907, 1913,1931,1933	12	{1871,1892,1913}	21	B
				{1873,1893,1913}	20	C
				{1879,1893,1907}	14	C
44	[1936,2025[	1949,1951,1973,1979,1987, 1993,1997,1999,2003, 2011,2017	11	{1949,1980,2011}	31	B
				{2029,2070,2111}	41	B
				{2039,2069,2099}	30	A
				{2053,2071,2089}	18	C
45	[2025,2116[	2027,2029,2039,2053,2063,2069, 2081, 2083,2087,2089,2099,2111,2113	13	{2027,2070,2113}	43	B
				{2029,2070,2111}	41	B
				{2053,2071,2089}	18	C
46	[2116,2209[	2129,2131,2137,2141,2143, 2153,2161,2179 ;2203,2207	10	{2143,2161,2179}	18	A
47	[2209,2304[	2213,2221,2237,2239,2243, 2251,2267,2269,2273, 2281,2287,2293,2297	13	{2221,2257,2293}	36	C
				{2243,2256,2269}	13	B
				{2243,2255,2267}	12	A
48	[2304,2401[	2309,2311,2333,2339,2341, 2347,2351,2357,2371,2377, 2381,2383,2389,2393,2399	15	{2311,2352,2393}	41	B
				{2333,2352,2371}	19	B
				{2309,2351,2393}	42	A
				{2347,2353,2359}	6	C
49	[2401,2500[	2411,2417,2423,2437,2441, 2447,2459,2467,2473 ;2477	10	{2423,2450,2477}	27	B
				{2441,2450,2459}	9	B

50	[2500,2601[	2503,2521,2531,2539,2543, 2549,2551,2557,2579, 2591,2593	11	{2521,2550,2579}	29	B
				{2543,2550,2557}	7	B
				{2549,2550,2551}	1	B
51	[2601,2704[	2609,2617,2621,2633,2647, 2657,2659,2663,2671,2677, 2683,2687,2689,2693,2699	15	{2647,2652,2657}	5	B
				{2617,2652,2687}	35	B
				{2609,2651,2693}	42	A
52	[2704,2809[	2707,2711,2713,2719,1729, 2731,2741,2749,2753,2767, 2777,2789,2791,2797, 2801,2803	16	{2711,2756,2801}	45	B
				{2713,2755,2797}	42	A
				{2719,2755,2791}	36	A
53	[2809,2916[	2819,2833,2837,2843,2851, 2857,2861,2879,2887, 2897,2903,2909	12	{2837,2862,2887}	25	B
				{2819,2861,2903}	42	A
				{2843,2861,2879}	18	A
54	[2916,3025[	2917,2927,2939,2953,2957, 2963,2969,2971,2999, 3001,3011,3019,3023	13	{2917,2970,3023}	53	B
				{2927,2969,3011}	42	A
				{2939,2969,2999}	30	A
				{2969,2970,2971}	1	B
55	[3025,3136[	3037,3041,3049,3061,3067, 3079,3083,3089,3109, 3119,3121	11	{3041,3080,3119}	39	B
				{3041,3081,3121}	40	C
				{3049,3079,3109}	30	A
				{3079,3081,3083}	2	C
56	[3136,3249[	3137,3163,3167,3169,3183, 3187,3191,3203,3209, 3217,3221,3229	12	{3163,3192,3221}	29	B
				{3167,3192,3217}	25	B
				{3169,3193,3217}	24	C
				{3183,3193,3203}	10	C
57	[3249,3364[	3251,3253,3257,3259,3271, 3299,3301,3307,3313,3319, 3323,3329,3331,3343, 3347,3359,3361	17	{3251,3306,3361}	55	B
				{3253,3306,3359}	53	B
				{3271,3307,3343}	36	C
				{3301,3307,3313}	6	C
58	[3364,3481[	3371,3373,3389,3391,3407, 3413,3433,3449,3457, 3461,3463,3467,3469	13	{3389,3423,3457}	34	C
				{3413,3423,3433}	10	C
				{3373,3421,3469}	48	A

59	[3481,3600[3491,3499,3511,3517,3527,	14	{3499,3540,3581}	41	B
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		3529,3533,3539,3541,3547, 3557,3559,3571,3581		{3511,3541,3571}	30	C
60	[3600,3721[3617,3623,3631,3637,3643, 3659,3671,3673,3677,3691 ,3697,3701,3709,3719	14	{3623,3660,3697}	37	B
				{3617,3659,3701}	42	A
				{3631,3661,3691}	30	C
61	[3721,3844[	3727,2733,3739,3761,3767, 3769,3779,3793,3797	9	{3761,3782,3803}	21	B
				{3767,3782,3797}	15	B
				{3769,3783,3797}	14	C
				{3769,3781,3793}	12	A
62	[3844,3969[	3847,3851,3863,3877,3881, 3889,3907,3911,3917,3919, 3923,3929,3931,3943,3947	15	{3847,3907,3967}	60	C
				{3863,3905,3947}	42	A
				{3881,3906,3931}	25	B
				{3889,3906,3923}	17	B
63	[3969,4096[	3989,4001,4003,4007,4013, 4019,4021,4027,4049, 4051,4057,4073	12	{3989,4031,4073}	42	A
				{4007,4032,4057}	25	B
				{4013,4032,4051}	19	B
64	[4096,4225[	4099,4111,4127,4129,4133, 4139,4153,4157,4159,4177, 4201,4211,4217,4919	14	{4099,4159,4219}	60	A
				{4111,4161,4211}	50	C
				{4133,4161,4289}	28	C
65	[4225,4356[	4229,4231,4241,4243,4253, 4259,4261,4271,4273,4283, 4289,4297,4327,4337, 4339,4349	16	{4229,4289,4349}	60	A
				{4241,4290,4339}	49	B
				{4241,4289,4337}	48	A
				{4243,4291,4339}	48	C
66	[4356,4489[	4357,4363,4373,4391,4397, 4409,4421,4423,4441,4447, 4451,4457,4463,4481,4483	15	{4363,4423,4483}	60	C
				{4391,4421,4451}	30	A
				{4397,4422,4447}	25	B
67	[4489,4624[	4493,4507,4517,4519,4523, 4547,4549,4561,4567,4583, 4591,4597,4603,4621	14	{4493,4557,4621}	64	C
				{4523,4557,4591}	34	C
68	[4624,4761[	4637,4639,4643,4649,4651, 4657,4663,4673,4679,4691, 4703,4721,4723,4729, 4733,4751,4759	17	{4651,4692,4733}	41	B
				{4649,4691,4733}	42	A
				{4663,4693,4723}	30	C

69	[4761,4900[	4783,4787,4793,4799,4801, 4813,4817,4831,4861, 4871,4877,4889	12	{4799,4830,4861}	31	B
				{4787,4829,4871}	42	A
				{4801,4831,4861}	30	C
70	[4900,5041[	4903,4909,4919,4931,4933, 4937,4943,4951,4957,4967, 4969,4973,4987,4993, 4999,5003,5009,5011, 5021,5023,5039	21	{4937,4970,5003}	33	B
				{4919,4971,5023}	52	C
				{4943,4971,4999}	28	C
				{4951,4969,4987}	18	A
				{4969,4971,4973}	2	C
71	[5041,5184[	5051,5059,5077,5081,5087, 5099,5101,5107,5113,5119, 5147,5153,5167,5171,5179	15	{5077,5112,5147}	35	B
				{5051,5111,5171}	60	A
				{5059,5113,5167}	54	C
				{5107,5113,5119}	6	C
72	[5184,5329[	5189,5197,5209,5227,5231, 5233,5237,5261,5273,5279, 5287,5297,5303, 5309,53023	15	{5189,5256,5323}	67	B
				{5237,5255,5273}	18	A
				{5231,5256,5279}	23	B
				{5233,5257,5281}	24	C
73	[5329,5476[	5333,5347,5351,5387,5393, 5399,5407,5413,5417,5419	10	{5333,5402,5471}	69	B
				{5387,5403,5419}	16	C
				{5393,5403,5413}	10	C
74	[5476,5625[	5477,5479,5483,5501,5503, 5507,5509,5519,5521,5531, 5557,5563,5569,5573, 5581,5591,5623	17	{5477,5550,5923}	73	B
				{5519,5550,5581}	31	B
				{5507,5540,5573}	33	B
				{5531,5550,5569}	19	B
75	[5625,5776[	5639,5641,5647,5651,5653, 5657,5659,5669,5683,5689, 5693,5701,5711,5717, 5737,5741,5743,5749	18	{5659,5700,5741}	41	B
				{5683,5700,5717}	17	B
				{5689,5700,5711}	11	B
				{5659,5701,5743}	42	C
				{5653,5701,5749}	48	C
76	[5776,5929[	5779,5783,5791,5801,5807, 5813,5821,5827,5833,5843, 5849,5851,5857,5861,5867, 5869,5879,5881,5887,	22	{5801,5852,5903}	51	B
				{5807,5852,5897}	45	B
				{5833,5851,5869}	18	A
				{5849,5853,5857}	4	C

		5903,5923,5927		{5843,5852,5861}	9	B
77	[5929,6084[	5939,5953,5981,5987,6007, 6011,6029,6037,6043,6047, 6053,6067,6073,6079	14	{5939,6006,6073}	67	B
				{5981,6005,6029}	24	A
78	[6084,6241[	6089,6091,6101,6113,6121, 6131,6133,6143,6151,6163, 6173,6197,6199,6203, 6211,6217,6221,6229	18	{6113,6162,6211}	49	B
				{6121,6162,6203}	41	B
				{6101,6161,6221}	60	A
79	[6241,6400[	6247,6257,6263,6269,6271, 6277,6287,6299,6301,6311, 6317,6323,6329,6337,6343, 6353,6359,6361,6367, 6373,6379,6389,6397	23	{6287,6320,6353}	33	B
				{6311,6320,6329}	9	B
				{6271,6319,6367}	48	A
				{6277,6319,6361}	42	A
				{6301,6319,6337}	18	A
80	[6400,6561[	6421,6427,6449,6451,6469, 6473,6481,6491,6521, 6529,6547,6551,6553	13	{6469,6480,6491}	11	B
81	[6561,6724[	6563,6569,6571,6577,6581, 6599,6607,6619,6631,6653, 6659,6661,6673,6679,6689, 6691,6701,6703,6709,6719	20	{6581,6642,6703}	61	B
				{6631,6642,6653}	11	B
				{6581,6641,6701}	60	A
				{6607,6643,6679}	36	C
82	[6724,6889[	6733,6737,6761,6763,6779, 6781,6791,6793,6803,6823, 6827,6829,6833,6841,6857, 6863,6869,6871,6883	19	{6779,6806,6833}	27	B
				{6781,6805,6829}	24	A
				{6781,6802,6823}	21	B
83	[6889,7056[	6899,6907,6911,6917,6947, 6949,6959,6961,6967,6971, 6977,6983,6991,6997,7001, 7013,7019,7027,7039,7043	20	{6907,6973,7039}	66	C
				{6949,6973,6997}	24	C
				{6959,6971,6983}	12	A
				{6961,6972,6983}	11	B
84	[7056,7225[	7057,7069,7079,7103,7109, 7121,7127,7129,7151,7159, 7177,7187,7193,7207, 7211,7213,7219	17	{7103,7140,7177}	37	B
				{7129,7140,7151}	11	B
				{7069,7140,7211}	71	B
85	[7225,7396[	7229,7237,7243,7247,7253,	16	{7229,7311,7393}	82	C

		7283,7297,7307,7309,7321, 7331,7333,7349,7351, 7369,7393		{7253,7211,7369}	58	C
				{7297,7309,7321}	12	A
86	[7396,7569[	7411,7417,7439,7451,7457, 7459,7477,7487,7489,7499, 7507,7517,7523,7529,7537, 7541,7547,7549,7559,7561	20	{7417,7482,7547}	65	B
				{7457,7482,7507}	25	B
				{7433,7481,9529}	48	A
				{7477,7482,7487}	5	B
87	[7569,7744[	7573,7577,7583,7589,7591, 7603,7607,7621,7639,7643, 7649,7669,7673,7681,7607, 7691,7699,7703,7717, 7723,7727,7741	22	{7589,7656,7723}	67	B
				{7573,7657,7741}	84	C
				{7607,7655,7703}	48	A
				{7639,7656,7673}	17	B
				{7643,7656,7669}	13	B
88	[7744,7921[	7753,7757,7759,7789,7793, 7817,7823,7829,7841,7853, 7867,7873,7877,7879,7883,7919	16	{7789,7833,7877}	44	C
				{7789,7831,7873}	42	A
				{7823,7832,7841}	9	B
89	[7921,8100[	7927,7933,7937,7949,7951, 7963,7993,8009,8011,8017, 8039,8053,8059,8069, 8081,8087,8089,8093	18	{7927,8010,8093}	83	B
				{7933,8010,8087}	77	B
				{7963,8011,8059}	48	C
				{8009,8010,8011}	1	B
90	[8100,8281[	8101,8111,8117,8123,8147, 8161,8167,8171,8179,8191, 8209,8219,8221,8231,8233, 8237,8243,8263,8269,8273	20	{8111,8190,8269}	79	B
				{8117,8190,8263}	73	B
				{8161,8190,8219}	29	B
				{8171,8190,8209}	19	B
91	[8281,8464[	8187,8291,8293,8297,8311, 8317,8327,8353,8363,8369, 8377,8387,8389,8419,8423, 8429,8431,8443,8447,8461	20	{8297,8372,8447}	75	B
				{8311,8371,8431}	60	A
				{8353,8371,8389}	18	A
				{8369,8373,8377}	4	C
92	[8464,8649[	8467,8501,8513,8521,8527,8537, 8539,8543,8563,8573,8581,8597, 8599,8609,8623,8627,8629, 8641,8647	19	{8467,8557,8647}	90	C
				{8501,8555,8609}	54	A
				{8637,8555,8573}	18	A
93	[8649,8836[8663,8669,8677,8681,8689,8693,	23	{8663,8742,8821}	79	B

	8699,8707,8713,8719,8731,8737,	{8663,8741,8819}	78	A
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		8741,8747,8753,8761,9779,8783, 8803,8807,8819,8821,8831		{8707,8743,8779} {8737,8742,8747}
94	[8836,9025[	8837,8839,8849,8861,8863,8867, 8887,8893,8923,8929,8933,8941, 8951,8963,8969,8971,8999, 9001,9007,9011,9013	21	{8849,8930,9011} {8861,8930,8999} {8893,8931,8969} {8929,8931,8933}
95	[9025,9216[	9029,9041,9043,9049,9059,9067, 9091,9103,9109,9127,9133,9137, 9151,9157,9161,9173, 9181,9199,9203,9209	20	{9029,9119,9209} {9067,9120,9173} {9103,9120,9137} {9109,9121,9133}
96	[9216,9409[	9221,9227,9239,9241,9257,9277, 9281,9283,9293,9311,9329,9337, 9341,9343,9349,9371, 9377,9391,9397	19	{9221,9312,9403} {9281,9311,9341} {9283,9313,9343} {9283,9312,9341}
97	[9409,9604[	9413,9419,9421,9431,9433,9437, 9439,9461,9463,9467,9473,9479, 9491,9497,9511,9521,9533,9539, 9547,9551,9587,9601	22	{9413,9507,9601} {9467,9507,9547} {9479,9506,9533} {9491,9506,9521}
98	[9604,9801[	9613,9619,9623,9629,9631,9643, 9649,9661,9677,9679,9689,9697, 9719,9721,9733,9739,9743,9749, 9767,9769,9781,9787,9741	23	{9613,9702,9791} {9619,9703,9787} {9623,9702,9781} {9661,9702,9743}
99	[9801,10000[9807,9811,9817,9829,9833,9839, 9851,9857,9859,9871,9883,9923, 9929,9931,9941,9949,9967,9973	18	{9829,9901,9973} {9857,9899,9941} {9871,9900,9929}
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