On the Distribution of Prime Numbers
Analysis of the Distribution of Prime Numbers Based on the Distribution of Composite Numbers and the Associated Patterns That Arise from the Redistribution of Natural Numbers in Triplets.

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While attempting to predict a strategy that would counter the casino's advantage, I came across two prime numbers with a particular arrangement within the columns and in the roulette itself. I started looking for other numbers within those columns that met the same criteria, and to my surprise, in the first column, there were more such numbers; in the second column, only one; and in the third, only two combinations.

Then, I set out to analyze the probability of each column in each spin. I examined the numbers by sectors, then the numbers adjacent to the last played number, as well as the neighbors of the position of the last number. Finally, I thought: "What if I analyze the probability of obtaining a prime number?" I marked these on the roulette table and, to my surprise, they were few. Then, I decided to analyze the composite numbers, as they are more abundant.

Upon examining these and observing their behavior, I noticed that prime numbers occupy specific positions within the real numbers. When distributing real numbers in triplets, each row contains at most one prime number, while the spaces without prime numbers form triplets of composite numbers.

Results:
Let us analyze the distribution of prime numbers within the real numbers:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, …, n-1, n, n+1.

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1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Fuente: Wikipedia (https://es.wikipedia.org/wiki/N%C3%BAmero_primo)

Prime numbers appear in a position that coincides with the specific prime number being examined. This is the simplest series to analyze (assuming a series that starts at n=1):
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, …, p, q.

If we analyze the differences between the terms, we do not find any visible pattern or a simple way to generate them. Therefore, at first, no periodicity is observed.

Now, let us distribute the first prime numbers into three columns, as in the casino. Mathematically, this equates to three sets that do not contain each other or three disjoint series:

1	2	3
4	5	6

7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36

Beyond the first row, all rows contain at most one prime number. The pattern appears to be alternating, although in certain rows it breaks.

Rule Number 1

Now, we will define a rule that arises from analyzing a simple strategy for playing roulette: betting on the number opposite the last played number. If we follow this rule, we will realize that the opposite of an odd number is an even number that is greater by one unit, and that every even number is opposite to an odd number that is smaller by one unit.

"Every prime number in a row must always be accompanied to its right by an even number."

Rule Number 2

"The third column contains only one prime number, and that prime number is 3, which occurs when n=0."

Now, let us group the numbers into Odd-Even pairs:

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36

Now, in this new arrangement, let us mark the prime numbers in red.

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36

From this new arrangement, the following conclusions can be drawn:

Each row can contain only one prime number.
- Prime number gaps are areas where the triplets are composed of composite numbers.
- The number of prime numbers in any given range will be less than ⅓ of the total elements that make up the set.

When grouping the numbers into three columns, a set of canonical progressions or single-variable equations emerges (there may be better definitions, but the simplest ones are these three):

- **Column 1:** f(x) = 3x + 1
- **Column 2:** g(y) = 3x + 2
- **Column 3:** h(z) = 3x + 3

Triplet Theorem

From this definition, I can conclude the following:
"The ordered set of natural numbers is the set of ordered points of the form [f(x), g(y), h(z)], where x, y, and z take real values."

Triplet Analysis

When rearranging numbers into triplets, it is evident that when triplets of composite numbers appear, a gap is created. This, in itself, is not very helpful, but if we reflect on it, we can notice that between two triplets of composite numbers, or between groups of composite number triplets, there must be at least one prime number. Thus, identifying these triplets is of vital importance in determining where a prime number is or will be found, or conversely, where not to search.

The simplest triplet to analyze is the odd-even one, where the odd number ends in 5 and the even number in 6 (a multiple of two). However, due to the column organization, finding where numbers ending in 5 appear is sufficient.

Now, let us analyze how triplets are distributed to determine patterns:

1 mod(3)	2mod(3)	0mod(3)
f(x) = 3x +1	**g(y) = 3y + 2**	**h(z) = 3z + 1**
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)
1mod(2)	0mod(2)	1mod(2)
0mod(2)	1mod(2)	0mod(2)

In the first column, every number divided by 3x + 1 has a remainder of 1; in the second, every number divided by 3x + 2 has a remainder of 2; and in the third, every number divided by 3z + 3 has a remainder of 0.

Each row alternates a rather distinguishable and obvious pattern (even and odd), and based on this pattern, we can analyze the distribution of triplets.

For a row to be a prime number gap, its three elements must be composite numbers, or alternatively, they could all be even numbers. However, according to the casino distribution, there can only be two even numbers per row.

We must also consider that all the elements in the third column are multiples of three, so any number in that column will be composite, as it will at least have the factors 1 and 3, which, by definition, are distinct from 3 for any row index greater than 0.

Therefore, we only need to focus on analyzing columns 1 and 2.

Now, let’s observe the following casino distribution

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60
61	62	63
64	65	66
67	68	69
70	71	72
73	74	75
76	77	78
79	80	81
82	83	84
85	86	87
88	89	90
91	92	93
94	95	96
97	98	99
100	101	102
103	104	105
106	107	108
109	110	111
112	113	114
115	116	117
118	119	120
121	122	123
124	125	126
127	128	129
130	131	132
133	134	135
136	137	138
139	140	141
142	143	144

			indice
1	2	3	0
4	5	6	1
7	8	9	2
10	11	12	3
13	14	15	4
16	17	18	5
19	20	21	6
22	23	24	7
25	26	27	8
28	29	30	9
31	32	33	10
34	35	36	11
37	38	39	12
40	41	42	13
43	44	45	14
46	47	48	15
49	50	51	16
52	53	54	17
55	56	57	18
58	59	60	19
61	62	63	20
64	65	66	21
67	68	69	22
70	71	72	23
73	74	75	24
76	77	78	25
79	80	81	26
82	83	84	27
85	86	87	28
88	89	90	29
91	92	93	30
94	95	96	31
97	98	99	32
100	101	102	33
103	104	105	34
106	107	108	35
109	110	111	36
112	113	114	37
115	116	117	38
118	119	120	39
121	122	123	40
124	125	126	41
127	128	129	42
130	131	132	43
133	134	135	44
136	137	138	45
139	140	141	46
142	143	144	47

When analyzing the pattern where the pair of numbers ending in 5 and 6 appears, it is possible to demonstrate that the progression of numbers 8, 11, 18, 21, 28, 31, 41 is given by two series.

For numbers of the form $3x + 1$, the elements where $3x + 1$ ends in 5 only occur when $n = 10K + 8$, where K is an integer.

For numbers of the form $3y + 2$, a number ending in 5 will occur when $n = 10K + 1$.
Therefore, the progression of numbers 8, 11, 18, 21, 28, 31, 41, … is given by the following relation: $(3x + 1 \mid n = 10K + 8), (3x + 2 \mid n = 10K + 1)$

For the same value of K, two pairs of values are obtained.

	Indices			
	mayor	menor		
K	10k+8	10k+1	3x + 1	3y + 2
0	8	1	25	5
1	18	11	55	34
2	28	21	85	64
3	38	31	115	94
4	48	41	145	124
5	58	51	175	154
6	68	61	205	184
7	78	71	235	214
8	88	81	265	244
9	98	91	295	274
10	108	101	325	304

There are other triplets or gaps that present other patterns, such as:

- $3x + 1 = 49$, $3y + 2 = 50$, $3z + 3 = 51$, numbers ending in 9 and 0
- $3x + 1 = 76$, $3y + 2 = 77$, $3z + 3 = 78$, numbers ending in 7 and 8
- $3x + 1 = 91$, $3y + 2 = 92$, $3z + 3 = 93$, numbers ending in 1 and 2
- $3x + 1 = 133$, $3y + 2 = 144$, $3z + 3 = 145$, numbers ending in 3 and 4

Conjecture: "There must exist a simple and straightforward series that defines the indices where prime numbers can be found. However, the series that indicates the distribution of prime numbers must be defined by more than two parametric equations that define their indices."

Definition of the product of two real numbers:
The product of two real numbers / Product of two prime numbers
Given the canonical equations: • Column 1: $f(x) = 3x + 1$ • Column 2: $g(y) = 3y + 2$ • Column 3: $h(z) = 3z + 3$

We can conclude that the product of two integers is the result of multiplying two of these three canonical equations.

A number raised to the power of two (minimum condition, although there is a more complete condition that involves multiplying the prime factors of two natural numbers) is a number such that:
F(x) = f(x)**2, G(y) = g(y)**2, H(z) = h(z)**2

If we take the product of two prime numbers p and q such that $p \neq q$ and both are different from 3, we obtain the following hyperbola (when the two numbers being multiplied are of the same canonical form, a parabola is obtained):
$(3x + 1)(3y + 2) = KP^2$

where KP^2 is the product of p and q.

More generally:
"The product of all prime numbers p and q defines all the level curves of the function:"
$9xy + 6x + 3y + 2 = KP^2$

- Every equation of the form $9xy + 6x + 3y + 2 = KP^2$ has a unique positive integer solution.
- All points on the curve $9xy + 6x + 3y + 2 = KP^2$ are constant and equal to the product of p and q