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Prime Numbers as Natural Numbers outside an Infinite Multiplication Table

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Abstract: *The purpose of this article is shedding light on prime numbers, namely by identifying them as the set of numbers outside an infinite multiplication table, under certain conditions. It was found that a formula which yields the set of prime numbers between 1 and infinity and between 1 and n, can be identified as well.*
Keywords: *Infinite multiplication table, natural numbers, prime numbers.*

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I. Introduction

Prime numbers are a fundamental subfield of inquiry within mathematics and there are many paths to explore it. Through this publication, we want to explore one of these possible paths within prime number research, namely, identifying the set of prime numbers as natural numbers outside an infinite multiplication table, under certain conditions. The final finding presented in this article, is a formula able to yield the set of primes between 1 and infinity and 1 and n.

II. Theoretical Framework

2.1 Prime numbers

Beyond any alternative definitions that we may find, prime numbers are simply those having two factors, namely one and the number itself (Kumar ＆ Mozar, 2020).

2.1.1 Prime numbers and multiplication tables

In the case of this article, we will use a multiplication table to represent the fact that, under certain conditions, prime numbers are all numbers that cannot be within a multiplication table (Hazaymeh ＆ Hazaymeh, 2020; Stenger, 1969). The conditions for a multiplication table of this kind, are that it must be infinite, and also have all orderly factors from 2 on, in order to obtain the outcomes within the table. A proposal of this nature is to be developed through this article.

III. Discussion

To begin with we have an infinite multiplication table and an initial statement about it. The initial statement is the following: Everything outside an infinite multiplication table with all orderly factors from 2 on, is prime (Hazaymeh ＆ Hazaymeh, 2020; Stenger, 1969). We can represent this idea as follows:

*	2	3	4	5
2	4	6	8	10
3	6	9	12	15
4	8	12	16	20
5	10	15	20	25

, in which we have factors from 2 on to infinity. As we can see it is easier to represent all this through a square so the diagram has a simpler comprehension. However in the case of the limit between 1 and 25 as we have shown, there are additional non-primes outside the "square" itself. In this case we have for example, the multiplication 2x11 = 22, which is outside the 5x5 square in the diagram but at the same time, within the 1－25 range. Therefore we have to consider the tangential multiplications within that range as well. This is shown more clearly in the following diagram:

*	2	3	4	5	6	7	…
2	4	6	8	10			

3	**6**	**9**	**12**	**15**	**18**	**21**
4	**8**	**12**	**16**	**20**	**24**	
5	**10**	**15**	**20**	**25**		
…						
11	**22**					
…						

As we can see, we have numbers 21, 22, and 24, which are not prime, outside the 5x5 square; however, they are in the 1—25 range, as we have mentioned earlier. At this point we have to say there was always the option of representing this diagram in 3 or more dimensions. However, for practical reasons, the 2-dimension representation and mathematical systematization we have chosen, seems to be the most practical one. After these considerations we can take a look at the following deductions:

If
$x > 1$,

$y > 1$
, and if

$$(x > 1)(y > 1) = z$$

Then,
$P \notin z$

In other words, everything outside z is P, meaning everything outside a multiplication table like the one shown earlier, is prime (Hazaymeh & Hazaymeh, 2020; Stenger, 1969). In other words, prime numbers set is the substraction between natural numbers set and z, or $z = ((x > 1)(y > 1))_S$, where S here and in the following formulas, stands for set). We can show this through the following formula:

$P = (N > 1)_S - ((x > 1)(y > 1))_S$

However, we can discard the set feature from the formula. Therefore, after this adjustment the formula shows as follows:

$P = (N > 1) - (x > 1)(y > 1)$

We can adjust the formula even more, so as to represent the range of numbers between 1 and n, making the formula more efficient and useful. This shows as follows:

$P_{(1-n)} = ((N > 1) - (x > 1)(y > 1))_{(1-n)}$

Therefore, what we have here is the (almost) final version of the formula we have been looking for, a formula representing the set of primes within a range of natural numbers between 1 and n. There may be still some adjustments to be made to the formula, however, in the end it may be just a matter of presentation. For example, we could even add the set aspect from first formula shown, to some of the elements of last shown version, as follows:

$(P_S)_{(1-n)} = (N > 1)_S - (((x > 1)(y > 1))_S)_{(1-n)}$

IV. Conclusion

Through this article, we could identify prime numbers as those outside an infinite multiplication table, under certain conditions. Additionally, a formula that yields the set of primes between 1 and n (and between 1 and infinity), could be found as well.

References

[1]. Alvarez, R. (2024). A simple method for finding prime numbers: An infinite model based on binary numbers. International Journal of Scientific and Engineering Research. Vol. 15, No. 12.

[2]. Alvarez, R. (2025). Prime numbers, binary matrices and generation rules. International Journal of Research in Engineering and Science. Vol. 13, No. 10.

[3]. Alvarez, R. (2026). New insights on primes with binary number matrices. International Journal of Research in Engineering and Science. Vol. 14, No. 2.
[4]. Chang, J. (2014). Every complete binary tree is prime. International Journal of Computer Applications. Vol. 106, No. 14.
[5]. Hazaymeh, A. & Hazymeh, K. (2020). Multiplication tables for non-prime odd numbers, The untouched tables which will give us a better understanding of the distribution of prime odd numbers. [Preprint]. ResearchGate. DOI: 10.31221/osf.io/34vgk.
[6]. Kumar, A. & Mozar, S. (2020). Proceedings of the 3rd International Conference on Communications and Cyber Physical Engineering, p. 170. New York: Springer Nature.
[7]. Mazurkin, P. (2014). Series primes in binary. American Journal of Applied Mathematics and Statistics. Vol. 2, No. 2, pp. 60-65. Science and Education Publishing.
[8]. Stenger, D. J. (1969). Prime numbers from the multiplication table. The Arithmetic Teacher, 16(8), 617-620.