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Abstract

In this research investigation, the author presents a ‘Primeness Test’ which can be used to test if any given number is Prime.

Theory

Given any number \( p_n \), usually written in Base 10 as

\[
p_n = a_k a_{k-1} a_{k-2} \ldots a_3 a_2 a_1 a_0
\]

where

\[
a_k a_{k-1} a_{k-2} \ldots a_3 a_2 a_1 a_0 = \sum_{i=0}^{k} (a_i)10^i
\]

which can be written as

\[
\sum_{i=0}^{k} (a_i)10^i = a_0 + (p_n - a_0)
\]

Letting \((p_n - a_0) = z\) we note that \( z \) is a multiple of 10.

If \( p_n \) is to be Prime, then the values of \( a_0 \) cannot be Even, i.e., it must be Odd. This implies that \( z \) must be Even. Also, \( a_0 \) can possibly take the values of 1, 3, 7 and 9 only as it being 5 implies that \( p_n \) is divisible by 5. If \( p_n \) is not a Prime, we can write it as

\[
p_n = a_0 + z = r \quad \text{and/or}
\]

\[
p_n = a_0 + z = 3s \quad \text{and/or}
\]

\[
p_n = a_0 + z = 7t \quad \text{and/or}
\]

\[
p_n = a_0 + z = 9u
\]

For the case of Divisibility by 3, we write

\[
r = \frac{a_0 + z}{3}
\]

Since \( z \) is a multiple of 10, we can check if it is multiple of 3 by checking if
\[ z = 3(10)^{m_0} \text{ for } m_{10} = 1 \text{ to } g \text{ such that } 3(10)^{g_{m_{10}} + 1} > z \]

Also, since \( z \) is a multiple of 10, we can check if it is multiple of 3 by checking if
\[ z = 3(20)^{m_{20}} \text{ for } m_{20} = 1 \text{ to } g \text{ such that } 3(20)^{g_{m_{20}} + 1} > z \]

We repeat this procedure, so on, so forth until

\[ z = 3(80)^{m_{80}} \text{ for } m_{80} = 1 \text{ to } g \text{ such that } 3(80)^{g_{m_{80}} + 1} > z \text{ and} \]
\[ z = 3(90)^{m_{90}} \text{ for } m_{90} = 1 \text{ to } g \text{ such that } 3(90)^{g_{m_{90}} + 1} > z \]

We now present the analysis as follows:

<table>
<thead>
<tr>
<th>Divisibility by 3</th>
<th>( z ) is divisible by 3</th>
<th>( z ) is not divisible by 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( a_0 )</td>
<td>( a_0 + z ) is divisible by 3</td>
<td>( a_0 + z ) is not divisible by 3</td>
</tr>
</tbody>
</table>

When \( z \) is not divisible by 3, it is either lacking and/ or in excess by

\[ \pm 1 \text{ gives } \pm 1 + 1 = 2, 0 \]
Hence, \( a_0 + z \) is not divisible by 3 for the case of \( +1 \) (lacking and/ or in excess by) but is divisible by 3 for the case of \( -1 \) (lacking and/ or in excess by)

\[ \pm 2 \text{ gives } \pm 2 + 1 = 3, -1 \]
Hence, \( a_0 + z \) is divisible by 3 for the case of \( +2 \) (lacking and/ or in excess by) but is not divisible by 3 for the case of \( -2 \) (lacking and/ or in excess by)
<table>
<thead>
<tr>
<th>$a_0$</th>
<th>$z$ is divisible by 3</th>
<th>$z$ is not divisible by 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$a_0 + z$ is divisible by 3</td>
<td>When $z$ is not divisible by 3, it is either lacking and/or in excess by $\pm 1$ gives $\pm 1 + 3 = 4, 2$ Hence, $a_0 + z$ is not divisible by 3 $\pm 2$ gives $\pm 2 + 3 = 5, 1$ Hence, $a_0 + z$ is not divisible by 3</td>
</tr>
<tr>
<td>7</td>
<td>$a_0 + z$ is not divisible by 3</td>
<td>When $z$ is not divisible by 3, it is either lacking and/or in excess by $\pm 1$ gives $\pm 1 + 7 = 8, 6$ Hence, $a_0 + z$ is not divisible by 3 for the case of $+1$ (lacking and/or in excess by) but is divisible by 3 for the case of $-1$ (lacking and/or in excess by) $\pm 2$ gives $\pm 2 + 7 = 9, 5$ Hence, $a_0 + z$ is divisible by 3 for the case of $+2$ (lacking and/or in excess by) but is not divisible by 3 for the case of $-2$ (lacking and/or in excess by)</td>
</tr>
<tr>
<td>9</td>
<td>$a_0 + z$ is divisible by 3</td>
<td>When $z$ is not divisible by 3, it is either lacking and/or in excess by $\pm 1$ gives $\pm 1 + 9 = 10, 8$ Hence, $a_0 + z$ is not divisible by 3 $\pm 2$ gives $\pm 2 + 9 = 11, 7$ Hence, $a_0 + z$ is not divisible by 3</td>
</tr>
</tbody>
</table>

We repeat the same procedural analysis for
equal to 7 and 9.

From the above all cases, we can infer if 

\( p_n \)

is Prime or not.

**Moral**

*Fulfillment of Righteous Promise Is The Highest Virtue.*

**References**

Ramesh Chandra Bagadi

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**Tribute**

The author pays his sincere tribute to all those dedicated and sincere folk of academia, industry and elsewhere who have sacrificed a lot of their structured leisure time and have painstakingly authored treatises on Science, Engineering, Mathematics, Art and Philosophy covering all the developments from time immemorial until then, in their supreme works. It is standing on such treasure of foundation of knowledge, aided with an iota of personal god-gifted creativity that the
The author bases his foray of wild excursions into the understanding of natural phenomenon and forms new premises and scientifically surmises plausible laws. The author strongly reiterates his sense of gratitude and infinite indebtedness to all such ‘Philosophical Statesmen’ that are evergreen personal librarians of Science, Art, Mathematics and Philosophy.

**Dedication**

All of the aforementioned Research Works, inclusive of this One are Dedicated to Lord Shiva.