

NegativeDigitalRoot

Paul F. Marrero Romero

Compute the negative digital root of any negative integer

Definition

```
In[ ]:= Attributes[NegativeDigitalRoot] = {Listable};
```

```
In[ ]:= NegativeDigitalRoot[n_? (IntegerQ[#] && # < 0 &)] := n - (-9) * Floor[(n + 1) / -9]  
NegativeDigitalRoot[_] := Message[Error::InvalidInput]  
Error::InvalidInput = "The provided input is not a negative integer.";
```

Documentation

Usage

NegativeDigitalRoot[n]

gives the negative digital root for the negative integer n .

Details & Options

- Consider a negative integer n ,
when $n < 0$ the negative digital root of n is:
 - $NegativeDigitalRoot[n] = n - (-9) * Floor[(n+1) / -9]$,
- As an example, consider $n = -476$:
 - $NegativeDigitalRoot[-476] = (-476) - (-9) * Floor[(-476 + 1) / -9] = -8$.
 - $NegativeDigitalRoot[-476]$ returns -8.
- For any negative integer n :
 - $0 > NegativeDigitalRoot[n] \geq -9$.
- NegativeDigitalRoot threads elementwise over lists.

Examples

Basic Examples

Compute the negative digital root of - 476 :

```
In[ ]:= NegativeDigitalRoot[-476]
```

```
Out[ ]:= -8
```

Scope

NegativeDigitalRoot threads elementwise over lists:

```
In[ ]:= ListNint = {-123, -851, -43256, -9957412};
NegativeDigitalRoot[ListNint]
```

```
Out[ ]:= {-6, -5, -2, -1}
```

Compute the negative digital root of the terms that belong to the integer sequence A123183-OEIS and generate a new integer sequence:

```
In[ ]:= A123183 = {-1, -1, -2, -5, -14, -41, -122, -365, -1094, -3281, -9842, -29525, -88574,
-265721, -797162, -2391485, -7174454, -21523361, -64570082, -193710245,
-581130734, -1743392201, -5230176602, -15690529805, -47071589414,
-141214768241, -423644304722, -1270932914165, -3812798742494};
```

```
In[ ]:= NegativeDigitalRoot[A123183]
```

```
Out[ ]:= {-1, -1, -2, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5,
-5, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5, -5}
```

The following tabulation illustrates the values of the negative digital root applied to each term of the sequence A123183-OEIS:

```
In[ ]:= x = A123183; y = NegativeDigitalRoot[A123183];
TableForm[{x, y}, TableDirections → Row,
TableHeadings → {"A123183", "NDR (A123183)"}]
```

Out[]//TableForm=

A123183	NDR (A123183)
- 1	- 1
- 1	- 1
- 2	- 2
- 5	- 5
- 14	- 5
- 41	- 5
- 122	- 5
- 365	- 5
- 1094	- 5
- 3281	- 5
- 9842	- 5
- 29 525	- 5
- 88 574	- 5
- 265 721	- 5
- 797 162	- 5
- 2 391 485	- 5
- 7 174 454	- 5
- 21 523 361	- 5
- 64 570 082	- 5
- 193 710 245	- 5
- 581 130 734	- 5
- 1 743 392 201	- 5
- 5 230 176 602	- 5
- 15 690 529 805	- 5
- 47 071 589 414	- 5
- 141 214 768 241	- 5
- 423 644 304 722	- 5
- 1 270 932 914 165	- 5
- 3 812 798 742 494	- 5

Properties and Relations

The sum of the negative digital roots of two negative integers n, m is congruent to the negative digital root of the sum of those two integers, modulo -9, i.e., $-9 \mid \text{NDR}(n + m) - (\text{NDR}(n) + \text{NDR}(m))$:

```
In[ ]:= With[{n = RandomInteger[-10^11], m = RandomInteger[-10^11]}, Divisible[
  NegativeDigitalRoot[n + m] - (NegativeDigitalRoot[n] + NegativeDigitalRoot[m]), -9]]
Out[ ]:= True
```

The negative digital root can be computed using a closed formula in terms of Mod:

```
In[ ]:= With[{n = RandomInteger[-10^11]}, NegativeDigitalRoot[n] == Mod[n + 1, -9] - 1]
Out[ ]:= True
```

Possible Issues

NegativeDigitalRoot requires its input to be a negative integer:

```
In[ ]:= NegativeDigitalRoot[498576]
Error: The provided input is not a negative integer.
```

Source & Additional Information

Contributed By

Paul F. Marrero Romero

Keywords

- negative digital root
- modular arithmetic
- integers
- floor function

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Links

- [The Digital Root\(A010888-OEIS.org\).](#)
- [Digital Root\(Wolfram MathWorld\).](#)
- [About the Negative Digital Root.](#)

Author Notes

The function in question is applicable solely to negative integers. In the event that the objective is to utilize it with non-negative integers, it is recommended to seek the function designated as “AdditiveDigitalRoot” at the Wolfram Resource System.

Acknowledgements

This Mathematica function is the result of research conducted in the field of discrete mathematics at the Marrero Research Lab.

