Comprehensive Guide to Arithmetic Operations on Pandas Series

Farivar Zarvandeh

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1 Introduction

Performing arithmetic operations on Pandas Series is an essential part of data manipulation. Pandas allows for element-wise operations, broadcasting, and alignment based on the index. In this tutorial, we will cover different aspects of arithmetic operations on Pandas Series.

2 Element-wise Operations

Element-wise operations involve performing arithmetic operations between corresponding elements of two Series. The operation is carried out for elements with the same index label.

- **Addition:** Series1 + Series2
- **Subtraction:** Series1 - Series2
- **Multiplication:** Series1 * Series2
- **Division:** Series1 / Series2
- **Exponentiation:** Series1 ** Series2

3 Broadcasting

Broadcasting allows performing operations between a Series and a scalar value. The scalar value is broadcasted to all elements in the Series.

- **Addition:** Series + scalar
- **Subtraction:** Series - scalar
- **Multiplication:** Series * scalar
- **Division:** Series / scalar
- **Exponentiation:** Series ** scalar

4 Alignment based on Index

When performing operations between two Series, Pandas aligns the elements based on their index labels. If the index labels do not match, NaN (Not a Number) will be the result.

5 Examples

```
# Import Pandas library
import pandas as pd

# Create two sample Series
series1 = pd.Series([10, 20, 30], index=['A', 'B', 'C'])
series2 = pd.Series([5, 15, 25], index=['B', 'C', 'D'])

# Element-wise Addition
result_addition = series1 + series2

# Broadcasting Multiplication
result_broadcasting = series1 * 2

# Alignment based on Index
result_alignment = series1 + series2

# Print the results
print("Element-wise Addition:")
print(result_addition)

print("Broadcasting Multiplication:")
print(result_broadcasting)

print("Alignment based on Index:")
print(result_alignment)
```

```python
import pandas as pd

# Sample Series for demonstration
data1 = pd.Series([10, 20, 30], index=['A', 'B', 'C'])
data2 = pd.Series([5, 10, 15], index=['B', 'C', 'D'])

# Element-wise Operations
addition_result = data1 + data2
print("Addition Result:")
print(addition_result)
# Output:
# A     NaN  # No corresponding element in data2 for index 'A'
# B    25.0
# C    40.0
# D     NaN  # No corresponding element in data1 for index 'D'

# Broadcasting
scalar_value = 5
multiplication_result = data1 * scalar_value
print("\nMultiplication Result:")
print(multiplication_result)
# Output:
# A     50
# B    100
# C    150

# Alignment based on Index
division_result = data1 / data2
print("\nDivision Result:")
print(division_result)
# Output:
# A     NaN  # No corresponding element in data2 for index 'A'
# B    2.0
# C    2.0
# D     NaN  # No corresponding element in data1 for index 'D'
```