Neville's and Lagrange's Interpolating Polynomial

Assessment

1. Create a function named `Lagrange` which accepts a list as input. The list will contain the two vectors for the data points, one for the independent variable and another for the dependent variable. It should use Lagrange Interpolating Polynomial to solve for the n^{th} order polynomial that will fit the data points.

   The function must return the following variables in a list, with the following labels:

   - `polynomial_string`: the string version of the polynomial;
   - `polynomial_function`: the function version of the polynomial.

2. Create an R function named `Neville` which accepts an integer `x` and a list as inputs. The list will contain the two vectors for the data points, one for the independent variable and another for the dependent variable. It should use Neville's Interpolating Polynomial to predict the value of the function at `x` using the given data points.

   The function must return the following variables in a list, with the following labels:

   - `table`: the matrix used in computation;
   - `y`: the predicted value of the function at x.

As an example, the output for the particular data points coded in R will be the following:

```
> x = c(8, 9, 11, 12)
> y = c(0.9031, 0.9542, 1.0414, 1.0792)
> Lagrange(list(x, y))
$polynomial_string
[1] "function (x) 0.9031*(((x-9)*(x-11)*(x-12))/((8-9)*(8-11)*(8-12))) +
0.9542*(((x-8)*(x-11)*(x-12))/((9-8)*(9-11)*(9-12))) +
1.0414*(((x-8)*(x-9)*(x-12))/((11-8)*(11-9)*(11-12))) +
1.0792*(((x-8)*(x-9)*(x-11))/((12-8)*(12-9)*(12-11)))"

$polynomial_function
function (x)
0.9031 * (((x - 9) * (x - 11) * (x - 12))/((8 - 9) * (8 - 11) *
    (8 - 12))) + 0.9542 * (((x - 8) * (x - 11) * (x - 12))/((9 -
    8) * (9 - 11) * (9 - 12))) + 1.0414 * (((x - 8) * (x - 9) *
    (x - 12))/((11 - 8) * (11 - 9) * (11 - 12))) + 1.0792 * (((x -
    8) * (x - 9) * (x - 11))/((12 - 8) * (12 - 9) * (12 - 11)))
<environment: 0x59e2780>


> Neville(10, list(x, y))
$table
 xi |x-xi|    Pi0    Pi 1    Pi 2     Pi 3
  9      1 0.9542 0.99780 1.00030 1.000017
```

```
 11      1 1.0414 0.99530 0.99945 0.000000
  8      2 0.9031 0.99115 0.00000 0.000000
 12      2 1.0792 0.00000 0.00000 0.000000

$y
[1] 1.000017
```

Word Problem

Answer the given problem in a one whole sheet of yellow paper. Show your complete solution.

Use the given steam table for superheated H_2O at 200 MPa to find the corresponding entropy s for a specific volume v of 0.108 m^3/kg. Use the following methods:

a. Linear Regression
b. Newton's Divided Difference
c. Lagrange Interpolating Polynomial
d. Neville's Method

v (m^3/kg)	0.10377	0.11144	0.1254
s $(kJ/kg \bullet K)$	6.4147	6.5453	6.7664