Program Code:

```python
import numpy as np
# program for Linear Regression

# define the data lists and their lengths
xVals = [1, 2, 3, 4, 5, 6]
#yVals = [10, 12, 15, 13, 21, 19] - main yVals
yVals = [10, 12, 15, 13, 21, 60]
m = len(xVals)
n = len(yVals)

# define a function to perform linear regression
def LinReg() :
    global xVals, yVals
    global m, n
    sumx = 0; sumy = 0; sumxy = 0; sumxx = 0
    global slope
    global yInt

    for index in range(n) :
        sumx += xVals[index]
        sumy += yVals[index]
        sumxy += xVals[index] * yVals[index]
        sumxx += xVals[index] * xVals[index]
    slope = (n * sumxy - sumx * sumy) / (n * sumxx - sumx * sumx)
    yInt = (sumy * sumxx - sumx * sumxy) / (n * sumxx - sumx * sumx)
    print("-----------------------------------------------\n")
    print ("the predicted slope is: %0.2f" % slope)
    print ("the predicted intercept is: %0.2f" % yInt)
    print ("")
    print ("linear model: y = %0.2fx + %0.2f" % (slope, yInt))
    print ("")
```

```
    # perform interpolation and extrapolation here
    # Interpolation (number within the range)
    xInterp = 0
    yInterp = 0


    # Request an interpolated x-value from the program user,
    # with these code statements
    msg = "please provide an x-value for interpolation "
    xInterp = float(input(msg))

    # Compute and display the interpolated y-value with
    # the lines of code
    yInterp = slope * xInterp + yInt
    print ("interpolation results: %0.2f" % yInterp)

    # Extrapolation (Outside the range)
    xExtrap = 0
    yExtrap = 0

    # Request an extrapolated x-value
    msgExtrap = "Please provide an x-value for extrapolation: "
    xExtrap = float(input(msgExtrap))

    # Compute and display the extrapolated y-value
    yExtrap = slope * xExtrap + yInt
    print("Extrapolation result: y = %0.2f" % yExtrap)

    # Correlation Coefficient = r
    r = np.corrcoef(xVals, yVals)[0, 1]
    print("The correlation coefficient is: %0.2f" % r)
```

```
63      print("")
64
65      # Coefficient of determination = r^2
66      rSquared = r * r
67      print("The coefficeint of determination is: %0.2f" % rSquared,"\n")
68
69      # Strong or weak correlation?
70      if ( r >= 0.80 and r <= 1.00) :
71          print("Analysis: strong postitive correlation\n")
72      if ( r <= -0.80 and r >= -1.00) :
73          print("Analysis: strong negative correlation\n")
74      if ( r > -0.80 and r < 0.80) :
75          print ("Analysis: weak correlation\n")
76
77      print("-----------------------------------------------\n")
78
79
80
81
82
83  # call the Linear Regression function
84  LinReg()
85
```

The source code for my program shows the starter code for the LinReg() method and the added features such as the interpolation, extrapolation, correlation coefficient, coefficient of determination, and strength of correlation.

Changes made for the yVals:

```
# define the data lists and their lengths
xVals = [1, 2, 3, 4, 5, 6]
#yVals = [10, 12, 15, 13, 21, 19] - main yVals
yVals = [10, 12, 15, 13, 21, 60]
m = len(xVals)
n = len(yVals)
```

The commented out yVals was used for the “Regular Output” and the currently uncommented yVals was used to show an example of a weak correlation in the “Weak Correlation Output”.

Regular output:

```
---------------------------------------------

the predicted slope is: 2.00
the predicted intercept is: 8.00

linear model: y = 2.00x + 8.00

please provide an x-value for interpolation 3.5
interpolation results: 15.00
Please provide an x-value for extrapolation: 7.5
Extrapolation result: y = 23.00
The correlation coefficient is: 0.88

The coefficeint of determination is: 0.78

Analysis: strong postitive correlation

---------------------------------------------

PS C:\Users\dante\Intro to AI\LAB_5>
```

Weak correlation Output:

```
-------------------------------------------------

the predicted slope is: 7.86
the predicted intercept is: -5.67

linear model: y = 7.86x + -5.67

please provide an x-value for interpolation 3.5
interpolation results: 21.83
Please provide an x-value for extrapolation: 61
Extrapolation result: y = 473.62
The correlation coefficient is: 0.77

The coefficeint of determination is: 0.59

Analysis: weak correlation

-------------------------------------------------
```

Artificial Intelligence Reflection:

From an AI perspective, this project accomplished the analyzation of data. We can use the data to make mathematical calculations to thus make educated predictions for the future. We can use the correlation of the data to predict where values of y would be located from other values of x that were not included in the data.