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'''
----- Matlab / Python Assignment -----
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Class:- SY-Comp-B , Course:- Applied Mathematics-III
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'''
Q.1) Find the correlation coefficient without using inbuilt function of matlab
or python.
'''

import math

def correlationCoefficient(X, Y, n) :
    sum_X = 0
    sum_Y = 0
    sum_XY = 0
    squareSum_X = 0
    squareSum_Y = 0

    i = 0
    while i < n :

        sum_X = sum_X + X[i]

        sum_Y = sum_Y + Y[i]

        sum_XY = sum_XY + X[i] * Y[i]

        squareSum_X = squareSum_X + X[i] * X[i]
        squareSum_Y = squareSum_Y + Y[i] * Y[i]

        i = i + 1

    corr = (float)(n * sum_XY - sum_X * sum_Y)/(float)(math.sqrt((n *
squareSum_X -
    sum_X * sum_X)*(n * squareSum_Y -sum_Y * sum_Y)))
    return corr

X = [69, 72, 23, 99, 55, 44, 75, 82, 91, 72, 82, 70]      #a=23
Y = [58, 74, 61, 94, 67, 75, 57, 103, 60, 60, 86, 57]    #Roll No- 22 So, 80-
23=57

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n = len(X)

print("Correlation Coefficient is:- " )
print ('{0:.6f}'.format(correlationCoefficient(X, Y, n)))

'''
Output:-
Correlation Coefficient is:-
0.377831
'''

'''
Q.2) Find the rank correlation coefficient without using inbuilt function of
      matlab or python.
'''
def printVector(X):
    print(*X)

def rankify(X):

    N = len(X)

    Rank_X = [None for _ in range(N)]

    for i in range(N):

        r = 1
        s = 1

        for j in range(i):
            if (X[j] < X[i]):
                r += 1
            if (X[j] == X[i]):
                s += 1

        for j in range(i+1, N):
            if (X[j] < X[i]):
                r += 1
            if (X[j] == X[i]):
                s += 1

        Rank_X[i] = r + (s-1) * 0.5

    return Rank_X

def correlationCoefficient(X, Y):
    n = len(X)

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sum_X = 0
sum_Y = 0
sum_XY = 0
squareSum_X = 0
squareSum_Y = 0

for i in range(n):

    sum_X = sum_X + X[i]

    sum_Y = sum_Y + Y[i]

    sum_XY = sum_XY + X[i] * Y[i]

    squareSum_X = squareSum_X + X[i] * X[i]
    squareSum_Y = squareSum_Y + Y[i] * Y[i]

    corr = (n * sum_XY - sum_X * sum_Y) / ((n * squareSum_X -
                                             sum_X * sum_X) * (n * squareSum_Y
- sum_Y * sum_Y)) ** 0.5

    return corr

X = [69, 72, 23, 99, 55, 44, 75, 82, 91, 72, 82, 70] #a=23
Y = [58, 74, 61, 94, 67, 75, 57, 103, 60, 60, 86, 57] #Roll No- 23 So, 80-
23=57

rank_x = rankify(X)

rank_y = rankify(Y)

print("Vector X")
printVector(X)

print("Rankings of X")
printVector(rank_x)

print("Vector Y")
printVector(Y)

print("Rankings of Y")
printVector(rank_y)

print("Spearman's Rank correlation: ")
print(correlationCoefficient(rank_x, rank_y))

'''

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Output:-

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Vector X
69 72 23 99 55 44 75 82 91 72 82 70
Rankings of X
4.0 6.5 1.0 12.0 3.0 2.0 8.0 9.5 11.0 6.5 9.5 5.0
Vector Y
58 74 61 94 67 75 57 103 60 60 86 57
Rankings of Y
3.0 8.0 6.0 11.0 7.0 9.0 1.5 12.0 4.5 4.5 10.0 1.5
Spearman's Rank correlation:
0.2904929577464789
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