## **Newton's Backward difference.py**

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# Name: Newton's Backward difference

# Purpose: Implemention of Newton's Backward difference interpolation

#

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# Created:

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import math

#-------Input-------------

# creating an empty list

x = []

# number of elements as input

n = int(input("Enter number of elements : "))

print("Enter x cordinates : ")

# iterating till the range

for i in range(0, n):

ele = float(input("X"+str(i)+" : "))

x.append(ele) # adding the element

print(x)

y = []

print("Enter y cordinates : ")

# iterating till the range

for i in range(0, n):

ele = float(input("Y"+str(i)+" : "))

y.append(ele) # adding the element

print(y)

xi=float(input("Enter the point at which to evaluate the polynomial : "))

# create a table to hold the backward difference values

bwd\_diff\_table = [[0] \* n for i in range(n)]

# fill in the first column with the y-values

for i in range(n):

bwd\_diff\_table[i][0] = y[i]

# compute the backward difference values

for j in range(1, n):

for i in range(n - j):

bwd\_diff\_table[i][j] = (bwd\_diff\_table[i][j - 1] - bwd\_diff\_table[i + 1][j - 1])

# use the backward difference values to interpolate the polynomial

yi = bwd\_diff\_table[n - 1][0]

prod = 1

for j in range(1, n):

prod \*= (xi - x[n - j])

yi += (prod \* bwd\_diff\_table[n - j - 1][j]) / math.factorial(j)

print("The value of the polynomial at x="+str(xi)+" is "+str(yi))

Output :-

Enter number of elements : 6

Enter x cordinates :

X0 : 0.1

X1 : 0.3

X2 : 0.5

X3 : 0.7

X4 : 0.9

X5 : 1.1

[0.1, 0.3, 0.5, 0.7, 0.9, 1.1]

Enter y cordinates :

Y0 : -1.699

Y1 : -1.073

Y2 : -0.375

Y3 : 0.443

Y4 : 1.429

Y5 : 2.631

[-1.699, -1.073, -0.375, 0.443, 1.429, 2.631]

Enter the point at which to evaluate the polynomial : 1

The value of the polynomial at x=1.0 is 2.0501439999999997