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| 30 | NEWTON’S BACKWARD INTERPOLATION |

### Algorithm:-

***When we wish to find out the value of a unknown fraction Y=f (X) where the values Yi [where i = 0,1,2,3…n] are given and equidistance values of arguments (independent variable) Xi [where i = 0,1,2,3…n] for a value of the difference table which is near of end of the table then we use the Newton interpolation formula. Here FACTOR (N, I) is a function that returns the value of product N to (N+I) and the FACTORIAL (I) function returns the factorial value of I. Here is an algorithm that denotes Newton backward interpolation formula as follows:***

1. Read the number of row N in difference table.
2. Read the value of Xi and the corresponding value of Yi.
3. Read the value of X.
4. Repeat I = 1 to N–1 by 1 do

Repeat J = 0 to N–I–1 by 1 do

Set Y [I][J] **:**= Y [I–1][J+1] – Y [I–1][J]

[End of loop]

[End of loop]

1. Set U **:**= (X–XN-1)/(X1–X0)
2. Set SUM **:**= Y [0][N–1]
3. Repeat I = 1 to N–1 by 1 do

Set SUM **:**= SUM+FACTOR(U,I)/FACTORIAL(I)\*Y[I][N–I–1]

[End of loop]

1. Repeat I = 0 to N–1 by 1 do

Print ‘X [I]’.

Repeat J = 0 to N–1 by 1 do

If I ≥ N–J then

CONTINUE

Print ‘ Y [J][I] ’.

[End of for]

[End of for]

1. Print ‘ SUM ’.
2. Exit.

### Program:-

#include<stdio.h>

#include<conio.h>

#define max 10

**float** factorial(**int**);

**float** factor(**float,int**);

**void** main()

{

**float** x[max],y[max][max],sum,u,xn;

**int** n,i,j;

clrscr();

printf("\nHow many row in the difference table: ");

scanf("%d",&n);

printf("\nEnter the value of x:\n");

**for**(i=0;i<n;i++)

scanf("%f",&x[i]);

printf("\nEnter the correspond value of y:\n");

**for**(i=0;i<n;i++)

scanf("%f",&y[0][i]);

printf("\nEnter the value of xn: ");

scanf("%f",&xn);

**for**(i=1;i<n;i++)

{

**for**(j=0;j<n-i;j++)

y[i][j]=y[i-1][j+1]-y[i-1][j];

}

u=(xn-x[n-1])/(x[1]-x[0]);

sum=y[0][n-1];

**for**(i=1;i<n;i++)

sum=sum+factor(u,i)/factorial(i)\*y[i][n-1-i];

printf("\nThe difference table:\n");

**for**(i=0;i<n;i++)

{

printf("%f ",x[i]);

**for**(j=0;j<n;j++)

{

**if**(i>=n-j)

**continue**;

printf("%f ",y[j][i]);

}

printf("\n\n");

}

printf("\nThe value of f(%f)=%f",xn,sum);

getch();

}

**float** factorial(**int** x)

{

**int** f,i;

**if**(x==0)

f=1;

**else**

{

f=1;

**for**(i=x;i>=1;i--)

f=f\*i;

}

**return**(f);

}

**float** factor(**float** n,**int** r)

{

**float** i,s=1;

**for**(i=0;i<r;i++)

s=s\*(n+i);

**return**(s);

}

### Output:-

How many row in the difference table **:** 5

Enter the value of x **:**

0 5 10 15 20

Enter the correspond value of y:

1.0 1.6 3.8 8.2 15.4

Enter the value of xn **:** 21