**CODE**:-

#include <stdio.h>

#include <stdlib.h>

int main()

{

int ch;

int n,i,j,c=0,d=0,first,second,diff;

float X,x[20],y[20],f[20][20],u,h,sum=0,prod=1,a,x1[100],y1[100];

printf("//////////NUMERICAL LAB PROJECT//////////\n");

printf("1.NEWTON'S FORWARD INTERPOLATION\n");

printf("2.NEWTON'S BACKWARD INTERPOLATION\n");

printf("3.LAGRANGE'S INTERPOLATION");

printf("\nEnter Your Choice:");

scanf("%d",&ch);

switch(ch)

{

case 1: printf("Forward Interpolation\n");

printf("Enter The Number Of Given Points");

scanf("%d",&n);

printf("\n");

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

{

printf("Enter x %d:",i);

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

printf("Enter y %d:",i);

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

}

first=x[0];

second=x[1];

diff=second-first;

for(i=0;i<n-1;i++)

{

if(x[i+1]-x[i]==diff)

c++;

else

d++;

}

if(d==0)

{

h=x[1]-x[0];

printf("Enter The Value of X to find y:\t");

scanf("%f",&X);

u=(X-x[0])/h;

sum=y[0];

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

{

f[0][j]=y[j];

}

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

{

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

{

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

}

}

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

{

prod=prod\*(u-i+1)/i;

sum=sum+prod\*f[i][0];

}

printf("\ny(%f)=%f\n",X,sum);

}

else

{

printf("The points are not at equal intervals");

}

break;

case 2 : printf("Backward Interpolation\n");

printf("Enter The Number Of Given Points");

scanf("%d",&n);

printf("\n");

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

{

printf("Enter x %d:",i);

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

printf("Enter y %d:",i);

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

}

first=x[0];

second=x[1];

diff=second-first;

for(i=0;i<n-1;i++)

{

if(x[i+1]-x[i]==diff)

c++;

else

d++;

}

if(d==0)

{

h=x[1]-x[0];

printf("Enter The Value of X to find y:\t");

scanf("%f",&X);

u=(X-x[n])/h;

sum=y[n];

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

{

f[0][j]=y[j];

}

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

{

for(j=1;j<=n;j++)

{

f[i][j]=f[i-1][j]-f[i-1][j-1];

}

}

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

{

prod=prod\*(u+i-1)/i;

sum=sum+prod\*f[i][n];

}

printf("\ny(%f)=%f\n",X,sum);

}

else

{

printf("\nThe points are not at equal intervals");

}

break;

case 3: printf("Lagrange's Interpolation");

printf("\nEnter The Value of n:");

scanf("%d",&n);

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

scanf("%f",&a);

printf("\nEnter The Variables:");

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

{

scanf("%f",&x1[i]);

}

printf("\nEnter The Functional Values:");

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

{

scanf("%f",&y1[j]);

}

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

{

prod=1;

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

{

if(i!=j)

prod=prod\*((a-x1[j])/(x1[i]-x1[j]));

}

sum=sum+prod\*y1[i];

}

printf("\nThe value of x=%f is %f",a,sum);

break;

default: printf("INVALID INPUT!!!!!!! PLEASE ENTER 1,2 OR 3");

}

return 0;

}