**PHƯƠNG PHÁP TÍNH (MAT 1099\_3)**

***Họ và tên: Phạm Văn Linh***

***Mssv: 14020822***

***Bài tập 3(chương 2): code lại bài tập 1, 2 tính đa thức nội suy Lagrange, Newton, Splime.(Dev C++).***

#include <iostream>

#include <cmath>

#include <fstream>

#include <iomanip>

#include <stdlib.h>

using namespace std;

int UCLN(int a, int b)

{//toi gian phan so

while(b != 0){

int t = b;

b = a % b;

a = t;

}

return a;

}

void Nhanhaiphanso(int tu1, int mau1, int tu2, int mau2, int &tu, int &mau)

{

tu = tu1\*mau2 + tu2\*mau1;

if(mau1 != 0 && mau2 != 0){

mau = mau1\*mau2;

int ucln = UCLN(tu, mau);

tu /= ucln;

mau /= ucln;

}

}

void Refresh\_intarray(int \*&a, int sophantu){

int i;

for(i = 0; i < 2\*sophantu; i++){

a[i] = 0;

}

}

void Refresh\_floatarray(float \*&a, int sophantu){

int i;

for(i = 0; i < 2\*sophantu; i++){

a[i] = 0;

}

}

void Creat(int \*&a, float \*&b, int sophantu)

{

a = new int [sophantu + 1];

b = new float [sophantu + 1];

}

void Del(int \*&a, float \*&b)

{

delete [] a;

delete [] b;

}

void Output(int tu1[], int mau1[], int sophantu, float lagrange[] , bool True)

{

int i;

for(i = sophantu; i >= 0; i--)

{

if(True){

if(tu1[i] == 0) continue;

if(mau1[i] == 1){

cout << tu1[i];

}else if(mau1[i] < 0){

cout << -tu1[i] << "/" << -mau1[i];

}else cout << tu1[i] << "/" << mau1[i];

if(i < 2){

if(i == 1) cout << "x" ;

}else{

cout << "x^" << i;

}

if(i > 0) cout << " + ";

}else{

if(lagrange[i] == 0) continue;

cout << lagrange[i];

if(i < 2){

if(i == 1) cout << "x" ;

}else{

cout << "x^" << i;

}

if(i > 0 && tu1[i - 1] != 0) cout << " + ";

}

}

}

bool SuydienNewton(float mang[][100], int sophantu)

{

int i = 0, j = 1;

float hesocachdeu;

hesocachdeu = mang[1][1] - mang[1][0];

for(i = 0; i < sophantu; i++){

if(hesocachdeu != mang[1][j] - mang[1][i]){

return false;

}

j++;

}

return true;

}

int Giaithua(int b)

{//tinh giai thua trong da thu noi suy Newton

int giatri = 1, i;

for(i = 1; i <= b; i++){

giatri = giatri\*i;

}

return giatri;

}

void Khoitaomau(int \*mau, int \*mau1, int sophantu)

{

int i;

for(i = 0; i <= sophantu; i++){

mau[i] = mau1[i] = 1;

}

}

int main()

{

int sophantu, i, j, k = 0, l, \*tu, \*mau, \*tu1, \*mau1, m, n, o, tt, mm, count = 0;

float x[100][100], \*mang, \*mang1, \*ketqua, hesoy, \*lagrange, hesocachdeu, \*heso, t;

bool True = true;

heso = new float[100];

Refresh\_floatarray(heso, sophantu);

do{

cout << "Nhap du lieu tu ban phim hoac tu file ???\n";

cout << "An 1 chon nhap tu ban phim, an 0 chon lay so lieu tu file.\n";

cin >> m;

if(m == 1 || m == 0) break;

}while(1);

if(m == 1)

{

do{

cout << "Nhap vao so phan tu:\n";

cin >> sophantu;

}while(sophantu < 2 || sophantu > 25);

Creat(tu, mang, sophantu); Creat(mau, mang1, sophantu);

Creat(tu1, ketqua, sophantu); Creat(mau1, lagrange, sophantu);

Refresh\_intarray(tu, sophantu); Refresh\_intarray(tu1, sophantu);

for(i = 0; i <= sophantu; i++) x[0][i] = i;//chi so khi hien ra

cout << "Nhap lan luot cac he so x, y da biet:\n";

for(i = 0; i <= sophantu; i++){

for(j = 1; j < 3; j++){

if(j == 1){

cout << "x["<<i<<"] = " ;

cin >> x[j][i];

}else{

cout << "y["<<i<<"] = " ;

cin >> x[j][i];

}

cout << "\n";

}

}

}else

{

fstream mofile;

mofile.open("solieu.txt", ios:: in);

if(mofile.fail())

{

cout << "Can't open own C++ source";

exit(1);

}

mofile >> sophantu;

Creat(tu, mang, sophantu); Creat(mau, mang1, sophantu);

Creat(tu1, ketqua, sophantu); Creat(mau1, lagrange, sophantu);

for(i = 0; i < 3; i++){

for(j = 0; j <= sophantu; j++){

mofile >> x[i][j];

}

}

mofile.close();

}

//tinh toan

for(i = 0; i < sophantu; i++){

if(x[1][i] - (int)x[1][i] != 0 || x[2][i] - (int)x[2][i]) True = false;

}

cout << "\nBang he so:\n";

for(i = 0; i < 3; i++ ){

for(j = 0; j <= sophantu; j++){

cout << x[i][j] << " ";

}

cout << "\n";

}

cout << "\n";

if(!SuydienNewton(x, sophantu))//tinh da thuc noi suy Lagrange

{

Khoitaomau(mau, mau1, sophantu);

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

{

hesoy = 1;

mang[0] = 1;

mang1[1] = 1;

for(o = 0; o <= sophantu; o++){

if(o != i) hesoy \*= (x[1][i] - x[1][o]);

}

tt = x[2][i];

mm = hesoy;

hesoy = x[2][i] / hesoy;

m = 1;

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

{

if(j != i){

for(l = 0; l < j + 1; l++)//nhan da thuc voi da thuc

{

mang1[0] = -x[1][j];

for(k = 0; k < 2; k++)

{

ketqua[l + k] += mang[l] \* mang1[k];

}

}

for(o = 0; o <= sophantu; o++)

{

mang[o] = ketqua[o];

ketqua[o] = 0;

}

}

}

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

{

tu[n] = tt \* mang[n];

mau[n] = mm;

mang[n] \*= hesoy;

lagrange[n] += mang[n];

Nhanhaiphanso(tu1[n], mau1[n], tu[n], mau[n], tu1[n], mau1[n]);

mang[n] = 0;

}

}

cout << "(\*\*\*) Da thuc noi suy Lagrange la: " << endl;

cout << "L(x) = ";

Output(tu1, mau1, sophantu, lagrange, True);

for(i = 0; i <= sophantu; i++){

heso[i] = lagrange[i];

if(lagrange[i] != 0) count++;

}

Refresh\_intarray(tu, sophantu); Refresh\_intarray(mau, sophantu);

Refresh\_intarray(tu1, sophantu); Refresh\_intarray(mau1, sophantu);

delete [] mang;

delete [] mang1;

}else//tinh da thuc noi suy Newton

{

float \*newton, \*newton1;

newton = new float[2\*sophantu];

newton1 = new float[2\*sophantu];

Refresh\_floatarray(newton, sophantu); Refresh\_floatarray(newton1, sophantu);

hesocachdeu = abs(x[1][1] - x[1][0]);

for(i = sophantu; i >0; i--){

for(j = i - 1; j >= 0; j--){

x[3 + k][j] = x[2 + k][j + 1] - x[2 + k][j];

}

k++;

}

cout << "\nHe so Delta y:\n";

for(i = 2; i <= sophantu + 2; i++){

cout << x[i][0];

if(i < sophantu + 2) cout << ", ";

mang[i - 2] = x[i][0];//tim duoc he so y

}

newton[0] = 1;

Khoitaomau(mau, mau1, sophantu);

Refresh\_intarray(tu, sophantu); Refresh\_intarray(tu1, sophantu);

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

{

if(i == 0){

mang1[1] = 0;

mang1[0] = 1;

}else{

mang1[1] = 1;

mang1[0] = -x[1][0] - hesocachdeu\*x[1][i];

}

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

{

for(k = 0; k < 2; k++){

ketqua[j + k] = roundf(ketqua[j + k] \* 1000000)/1000000 + roundf(newton[j] \* mang1[k] \* 1000000) / 1000000;

}

}

for(o = 0; o <= sophantu; o++)

{

newton[o] = ketqua[o];

tu[o] = mang[i] \* ketqua[o];

mau[o] = Giaithua(i)\*pow(hesocachdeu, i);

ketqua[o] = (mang[i]/(Giaithua(i))\*pow(hesocachdeu, i))\*ketqua[o];

Nhanhaiphanso(tu1[o], mau1[o], tu[o], mau[o], tu1[o], mau1[o]);

newton1[o] += ketqua[o];

ketqua[o] = 0;

}

}

cout << "\n\n\n(\*\*\*) Da thuc noi suy Newton la:" << endl;

cout << "Ln(x) = ";

Output(tu1, mau1, sophantu, newton, True);

for(i = 0; i <= sophantu; i++){

heso[i] = newton1[i];

if(newton1[i] != 0) count++;

}

Del(tu, lagrange); Del(tu1, ketqua);

Del(mau, newton); Del(mau1, newton1);

}

//tinh da thuc noi suy Splime

x[0][sophantu + 1] = sophantu + 1;

cout << "\n\nNhap tiep he so da biet de giai da thuc noi suy Splime:\n";

cout << "x["<<sophantu + 1<<"] = " ;

cin >> x[1][sophantu + 1];

cout << "y["<<sophantu + 1<<"] = " ;

cin >> x[2][sophantu + 1];

cout << "\nBang he so moi la:\n";

for(i = 0; i < 3; i++){

for(j = 0; j <= sophantu + 1; j++){

cout <<x[i][j] << " ";

}

cout << "\n";

}

if(count <= 1){//kiem tra neu count = 1 thi da thuc noi suy Newton suy cho cung co dang L(x) = a, khong

cout << "Khong the tim da thuc noi suy Splime. " << endl;// the tim duoc da thuc Splime

return 0;

}

count--;

float Hepttt[100][100], catche[100], Splime[100];//su dung mang 2 chieu de giai he pt tuyen tinh bang ma tran

int temp = count - 2;//dau ra cua pt newton la so bac toi da trong pt Splime

for(i = 0; i < 100; i++){

for(j = 0; j < 100; j++){

Hepttt[i][j] = 0;

}

}

k = count;

for(i = sophantu; i > sophantu - 2; i--){//xay dung 2 phuong trinh tt dau tien

for(j = count; j >= 0; j--){

Hepttt[k][count - j] = pow(x[1][i + 1], j);

}

k--;

}

Hepttt[count - 1][count + 1] = x[2][sophantu];

Hepttt[count][count + 1] = x[2][sophantu + 1];

//Xay dung (sophantu - 2) pttt con lai

sophantu = count;

for(i = sophantu; i > 1; i--){

for(j = 0; j < i; j ++){

Hepttt[temp][sophantu + 1] += heso[sophantu - j] \* (i - j) \* pow(x[1][sophantu], i - j - 1);

if(heso[sophantu - j] != 0 && i == sophantu){

catche[j] = 1;

}

Hepttt[temp][j] = (i - j) \* pow(x[1][sophantu], i - j - 1) \* catche[j];

heso[sophantu - j] \*= (i - j);

catche[j] \*= (i - j);

}

temp --;

}

cout << fixed << setprecision(2);//dinh dang so co dang thap phan lay 2 chu so sau dau phay

cout << "\nGiai he pt tuyen tinh duoi dang ma tran la:\n" << endl;

for(i = 0; i < sophantu + 1; i++){

for(j = 0; j < sophantu + 2; j++){

cout << Hepttt[i][j] << " ";

}

cout << endl;

}

cout << endl;

n = sophantu + 1;

for(i = 0; i < n - 1; i ++){//giai he pt

if(Hepttt[i][i] == 0){

continue;

}else{

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

t = -(Hepttt[j][i]/Hepttt[i][i]);

for(k = i; k <= n; k ++ ){

Hepttt[j][k] = roundf((t\*Hepttt[i][k] + Hepttt[j][k])\*1000000) / 1000000;//lam tron 6 chu so

}

t = 0;

}

}

}

int v = 0, z = 0, rankA, rankA\_1;

rankA = count;

rankA\_1 = rankA;

for(i = 0; i < sophantu + 1; i++){

for(j = 0; j < sophantu + 2; j++){

if(Hepttt[i][j] == 0 && j < sophantu + 1){

v++;

z++;

}else if(Hepttt[i][j] == 0 && j == sophantu + 1){

z++;

}

}

if(v == sophantu + 1){

rankA--;

}

if(z == sophantu + 2){

rankA\_1--;

}

v = 0;

z = 0;

}

if(rankA < rankA\_1){//tinh rank cua ma tran de phong truong hop he pt khong co nghiem

cout << "He phuong trinh vo nghiem. Khong tim duoc da thuc noi suy Splime. " << endl;

return 0;

}

for(i = sophantu; i >= 1; i--){//dua ve dang ma tran chuyen vi

for(j = i - 1; j >= 0; j--){

t = -(Hepttt[j][i]/Hepttt[i][i]);

for(k = i; k <= sophantu + 1; k++){

Hepttt[j][k] = roundf((t\*Hepttt[i][k] + Hepttt[j][k])\*100000) / 100000;

}

}

Splime[i] = Hepttt[i][sophantu + 1]/Hepttt[i][i];

}

Splime[0] = Hepttt[0][sophantu + 1]/Hepttt[0][0];

cout << endl << "(\*\*\*) Da thuc noi suy Splime la: \n";

cout << "Qm(x) = ";

for(i = 0; i <= sophantu; i++){

cout << Splime[i];

if(i < sophantu) cout << "x^" << sophantu - i << " + ";

}

return 0;

}

**Bài tập chương 3:**

**Đưa ra các số liệu(trên mạng) của VCB, VINCOM, FPT, VINAMIL, THẾ GIỚI DI ĐỘNG sau đó code lại để tính xấp xỉ hàm số theo Phương pháp bình phương tối thiểu(bậc nhất và bậc hai).(Dev c++).**

#include <iostream>

#include <cstdlib>

#include <iomanip>

#include <cmath>

#include <fstream>

using namespace std;

void Creat(float \*\*&array, int n)

{

int i;

array = new float \*[2\*n];

for(i = 0 ; i < 2\*n; i++)

array[i] = new float [2\*n];

}

void Delete(float \*\*&array, int n)

{

int i;

for(i = 0 ; i < 2\*n; i++)

delete [] array[i];

delete [] array;

}

void Refresh(float \*\*&array, int n)

{

int i, j;

for(i = 0 ; i < 2\*n; i++){

for(j = 0; j < 2\*n; j++)

array[i][j] = 0;

}

}

void Giaihepttt(float \*\*&hesopt, float \*&Splime, int n)

{

int i = 0, j, k;

float t;

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

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

t = -(hesopt[j][i]/hesopt[i][i]);

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

hesopt[j][k] = roundf((t\*hesopt[i][k] + hesopt[j][k])\*1000000) / 1000000;//lam tron 6 chu so

Add(tu1 \* tu[i][k], mau1 \* mau[i][i], tu[j][k], mau[j][k], tu[j][k], mau[j][k]);

}

}

}

for(i = n; i >= 1; i--){//dua ve dang ma tran chuyen vi

for(j = i - 1; j >= 0; j--){

t = -(hesopt[j][i]/hesopt[i][i]);

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

hesopt[j][k] = roundf((t\*hesopt[i][k] + hesopt[j][k])\*1000000) / 1000000;

Add(tu1 \* tu[i][k], mau1 \* mau[i][i], tu[j][k], mau[j][k], tu[j][k], mau[j][k]);

}

}

Splime[i] = hesopt[i][n + 1]/hesopt[i][i];

}

Splime[0] = hesopt[0][n + 1]/hesopt[0][0];

}

void Refresh1(float \*&array, int n)

{

int i;

for(i = 0 ; i < 2\*n; i++){

array[i] = 0;

}

}

int main()

{

int sophantu, i, j, k, n;

float \*Splime, \*\*mang, \*\*hesopt, t;

Splime = new float[100];

cout << "Vui long nhap du lieu tu trong file.\n";

fstream mofile;

mofile.open("solieu.txt", ios:: in);

if(mofile.fail()){

cout << "Can't open own C++ source";

exit(1);

}

mofile >> sophantu;

n = 1;//giai he pt bac nhat dang y(x) = a0x + a1

Creat(mang, sophantu); Creat(hesopt, sophantu);

Refresh(mang, sophantu); Refresh(hesopt, sophantu);

for(i = 0; i < sophantu; i++){

for(j = 0; j < sophantu; j++){

mofile >> mang[i][j];

}

}

mofile.close();

cout << "\nBang so lieu la: \n";

for(i = 0; i < 3; i++){

for(j = 0; j < sophantu; j++){

cout << mang[i][j] << " ";

}

cout << endl;

}

cout << "\n\nXay dung phuong trinh bac nhat tot nhat ";

cout << "theo binh phuong toi thieu theo cong thuc da cho." << endl;

hesopt[1][1] = sophantu;

for(i = 0; i < sophantu; i++)//xay dung he so pt bac nhat

{

hesopt[0][0] += pow(mang[1][i], 2);

hesopt[0][1] += mang[1][i];

hesopt[0][2] += mang[1][i] \* mang[2][i];

hesopt[1][2] += mang[2][i];

}

hesopt[1][0] = hesopt[0][1];

Refresh1(Splime, sophantu);

Giaihepttt(hesopt, Splime, n);

cout << endl << "(\*\*\*) Phuong trinh bac nhat can tim la: \n";

cout << "y(x) = ";

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

cout << Splime[i];

if(i < n) cout << "x^" << n - i << " + ";

}

cout << "\n\nXay dung phuong trinh bac hai tot nhat ";

cout << "theo binh phuong toi thieu theo cong thuc." << endl;

n = 2;//giai he pt bac 2 dang: y(x) a0x^2 + a1x + a2

Refresh(hesopt, sophantu);

Refresh1(Splime, sophantu);

for(i = 0; i < sophantu; i++)//xay dung cac he so cua phuong trinh bac hai

{

hesopt[0][0] += pow(mang[1][i], 4);

hesopt[0][1] += pow(mang[1][i], 3);

hesopt[0][2] += pow(mang[1][i], 2);

hesopt[0][3] += (pow(mang[1][i], 2) \* mang[2][i]);

hesopt[1][3] += mang[1][i] \* mang[2][i];

hesopt[2][3] += mang[2][i];

hesopt[1][2] += mang[1][i];

}

hesopt[1][0] = hesopt[0][1];

hesopt[1][1] = hesopt[0][2];

hesopt[2][0] = hesopt[0][2];

hesopt[2][1] = hesopt[1][2];

hesopt[2][2] = sophantu;

Giaihepttt(hesopt, Splime, n);

cout << endl << "(\*\*\*) Phuong trinh bac hai can tim la: \n";

cout << "y(x) = ";

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

cout << Splime[i];

if(i < n) cout << "x^" << n - i << " + ";

}

Delete(mang, sophantu);

Delete(hesopt, sophantu);

delete [] Splime;

return 0;

}