**International Islamic University Chittagong (IIUC)**

**Department of Computer Science Engineering (CSE)**

**LAB - 1**

**Course title : Numerical Methods Lab**

**Course code :CSE-4746**

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**Submitted To:**

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**1. Write a program to count the number of significant digits in a given number.**

#include<bits/stdc++.h>

using namespace std;

int trapCheck(int n, string c)

{

int fontDigit = 0;

int backDigit = 0;

int ans = 0;

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

{

if(c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

fontDigit++;

//cout << "TP f" << fontDigit << endl;

}

}

for(int i = n; i < c.size() ; i++)

{

if(c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

backDigit++;

//cout << "TP b" << backDigit << endl;

}

}

if(fontDigit > 0 && backDigit > 0)

{

ans = 1;

}

//cout << "TP ans" << ans << endl;

return ans;

}

int endCheck(int n, string c)

{

int fontDigit = 0;

int backDigit = 0;

int ans = 0;

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

{

if(c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

fontDigit++;

//cout << "TR f" << fontDigit << endl;

}

}

for(int i = n; i < c.size() ; i++)

{

if(c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

backDigit++;

//cout << "TR b" << backDigit << endl;

}

}

if(fontDigit > 0 && backDigit == 0)

{

ans = 1;

}

//cout << "TR ans" << ans << endl;

return ans;

}

int startCheck(int n, string c)

{

int fontDigit = 0;

int backDigit = 0;

int ans = 0;

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

{

if(c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

fontDigit++;

//cout << "LE f" << fontDigit << endl;

}

}

for(int i = n; i < c.size() ; i++)

{

if(c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

backDigit++;

//cout << "LE b" << backDigit << endl;

}

}

if(fontDigit == 0 && backDigit > 1)

{

ans = 1;

}

//cout << "LE ans" << ans << endl;

return ans;

}

int countSignificantFigures(string c)

{

/\*for (int i=0;i<c.size();i++)

{

cout << c[i] ;

}

cout << endl;\*/

int count = 0;

int trappedZeros = 0, leadingZeros = 0, trailingZeros = 0, trail = 0;

bool counting = false;

// Iterate through each character in the string

for (int i = 0; i < c.size(); i++)

{

if (c[i] == '1' || c[i] == '2' || c[i] == '3' || c[i] == '4' || c[i] == '5' || c[i] == '6' || c[i] == '7' || c[i] == '8' || c[i] == '9')

{

//cout << c[i] << endl;

//cout << count << endl;

count++;

//cout << count << endl;

}

else if (c[i] == '.')

{

// Decimal point encountered, reset counting flag

counting = true;

}

else if (c[i] == '0')

{

//cout << c[i] << endl;

if (trapCheck(i, c) == 1)

{

trappedZeros++;

//cout << "TP" << trappedZeros << endl;

}

else if(endCheck(i, c) == 1)

{

trailingZeros++;

//cout << "TR" << trailingZeros << endl;

}

else if(startCheck(i, c) == 1)

{

leadingZeros++;

//cout << "LE" << leadingZeros << endl;

}

}

}

int ans;

if(counting)

{

ans = count + trappedZeros + trailingZeros;

}

else

{

ans = count + trappedZeros + trail;

}

return ans;

}

int main()

{

///Peace be with you.

//optimize();

string number;

cout << "Enter a number: ";

getline(cin, number);

int significantDigits = countSignificantFigures(number);

cout << "The number of significant digits is: " << significantDigits << endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/yasGbMKKAT**](https://onlinegdb.com/yasGbMKKAT)

**2. Write a program to round off a number with n significant figures using banker’s rule.**

#include<bits/stdc++.h>

using namespace std;

int main()

{

///Peace be with you.

string number;

string output = "";

cout << "Enter the number: ";

getline(cin, number);

int n;

cout << "Enter Nth significant value: ";

cin >> n;

int decPoint;

for (int i = 0; i < number.size(); i++)

{

if(number[i] == '.')

{

decPoint = i+1;

//cout << decPoint << endl;

break;

}

}

int End = decPoint + n;

//cout << End << endl;

string result = "";

for(int i = 0; i < End; i++)

{

result += number[i];

//cout << result << endl;

}

//cout << result << endl;

int count = 0;

if((number[End] - '0') < 5)

{

result[End - 1] = number[End - 1];

}

else if((number[End] - '0') > 5)

{

int ans = (number[End - 1] - '0') + 1;

//cout << ans << endl;

string change = to\_string(ans);

//cout << change << endl;

result.replace(End - 1, result[End - 1], change);

}

else if((number[End] - '0') == 5)

{

if((number[End - 1] - '0') % 2 == 0)

{

result[End - 1] = number[End - 1];

}

else

{

int ans = (number[End - 1] - '0') + 1;

//cout << ans << endl;

string change = to\_string(ans);

//cout << change << endl;

result.replace(End - 1, result[End - 1], change);

}

}

cout << "Round off number: " << result << endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/aILffO4kh**](https://onlinegdb.com/aILffO4kh)

**3. Write a program to evaluate a polynomial f(x) = x^3 - 2x^2 + 5x + 10 by using Horner’s rule x = 5.**

#include <iostream>

using namespace std;

int main()

{

///Peace be with you.

int Order = 3;

int a[Order+1] = {1, -2, 5, 10}; // x^3 - 2x^2 + 5x + 10

int x = 5;

int p = a[0];

for(int i = 1; i <= Order; i++)

{

p = x\*p + a[i];

}

cout << p << endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/myRN5SMyu**](https://onlinegdb.com/myRN5SMyu)

**4. Write a program to find the root of the equation x^3 – 9x + 1 = 0, correct to 3 decimal places, by using the bisection method.**

#include<bits/stdc++.h>

using namespace std;

#define f(x) ((x\*x\*x) - (9\*x) + 1) // x^3 - 9x + 1 = 0

int main()

{

///Peace be with you.

double a = -1.0, b = 1.0, tolerance = 0.0005;

double c;

while(1)

{

if(fabs(a-b) < tolerance)

{

break;

}

c = (a+b)/2;

if (f(c)\*f(a) <0)

{

b = c;

}

else

{

a = c;

}

}

cout<<"The value of root is = "<< c <<endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/31Ya7yMVk**](https://onlinegdb.com/31Ya7yMVk)

**5. Write a program to find the root of the equation x^5 + 3x^2 - 10 = 0, correct to 3 decimal places, by using the fixed point method.**

#include<bits/stdc++.h>

using namespace std;

#define f(x) ((x\*x\*x\*x\*x) + (3\*(x\*x)) - 10) // x^5 + 3x^2 - 10 = 0

#define g(x) (sqrt(10 / ((x\*x\*x) + 3))) // x = sqrt(10 / (x^3 +3))

int main()

{

///Peace be with you.

double x0 = 0.0, x1, tolerance = 0.0005;

while(1)

{

x1 = g(x0);

if (fabs(x1 - x0) < tolerance)

{

break;

}

else

{

x0 = x1;

}

}

cout << "The value of root is = " << x1 <<endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/5S9F8inP4**](https://onlinegdb.com/5S9F8inP4)

**6. Write a program to find the root of the equation x^3 - 6x + 4 = 0, correct to 3 decimal places, by using Newton-Raphson method.**

#include<bits/stdc++.h>

using namespace std;

#define f(x) ((x\*x\*x) - (6\*x) + 4) // x^3 - 6x + 4

#define f2(x) ((3\*x\*x) - 6) // 3x^2 - 6

int main()

{

///Peace be with you.

double x0 = 0.0, x1, tolerance = 0.0005;

while(1)

{

x1 = (x0 - (f(x0)/f2(x0)));

if (fabs(x1 - x0) < tolerance)

{

break;

}

else

{

x0 = x1;

}

}

cout<<"The value of root is = "<< x1 <<endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/UuT\_1vbAH**](https://onlinegdb.com/UuT_1vbAH)

**7. Write a program to find the root of the equation x^3 - x + 2 = 0, correct to 3 decimal places, by using the false position method.**

#include<bits/stdc++.h>

using namespace std;

#define f(x) ((x\*x\*x) - (x) + 2) // x^3 - x + 2

int main()

{

///Peace be with you.

double x1 = 0.0, x2 = -2.0, x0, tolerance = 0.0005;

while(1)

{

x0 = x1 - ((f(x1)\*(x2-x1))/(f(x2)-f(x1)));

if(fabs(x1-x2) < tolerance)

{

break;

}

if (f(x0)\*f(x1) <0)

{

x2 = x0;

}

else

{

x1 = x0;

}

}

cout<<"The value of root is = "<< x0 <<endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/vhXrz7Kas**](https://onlinegdb.com/vhXrz7Kas)

**8. Write a program to find the root of the equation x^3 – 5x^2 –29 = 0, correct to 3 decimal places, by using the secant method.**

#include<bits/stdc++.h>

using namespace std;

#define f(x) ((x\*x\*x) - (5\*x\*x) - 29) // x^3 - 5x^2 - 29

int main()

{

///Peace be with you.

double x0 = 2.0, x1 = 4.0, x2, tolerance = 0.0005;

while(1)

{

x2 = x0 - ((f(x0)\*(x1-x0))/(f(x1)-f(x0)));

if (fabs(x1 - x0) < tolerance)

{

break;

}

else

{

x0 = x1;

x1 = x2;

}

}

cout<<"The value of root is = "<< x2 <<endl;

return 0;

}

**LINK :** [**https://onlinegdb.com/KOepBt9PO**](https://onlinegdb.com/KOepBt9PO)

**9. Write a program to find the quotient polynomial q(x) such that p(x) = (x - 2) q(x) where the polynomial p(x) = x^3 - 5x^2 + 10x - 8 = 0 has a root at x = 2.**

**MISS THE CLASS.**

**10. Write a program to find all the roots of the equation x^3 - 6x + 4 = 0, correct to 3 decimal places.**

**MISS THE CLASS.**