MATH 211.3 Winter Term 2024 Assignment

Assignment #01

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PROBLEM 1

A close-up of a paper with mathematical equations

Description automatically generated

A math equations on a piece of paper

Description automatically generated

COMP

**1**

clear;

clc;

% Define the value of x

x = 1.00001;

% Create a vector of coefficients for P(x) = 1 + x + x^2 + ... + x^50

coeff\_vector = ones(1, 51);

% Evaluate P(x) using the nest function

P\_x = nest(50, coeff\_vector, x);

% Evaluate Q(x) = (x^51 - 1) / (x - 1)

Q\_x = (x^51 - 1) / (x - 1);

% Calculate the error

error = abs(P\_x - Q\_x);

fprintf('P(%.5f) = %f\n', x, P\_x);

fprintf('Q(%.5f) = %f\n', x, Q\_x);

fprintf('Error = %e\n', error);

%Function: Nested multiplication

%Evaluates polynomial from nested form using Horner's method

%Input: degree d of polynomial,

% array of d+1 coefficients (constant term first),

% x-coordinate x at which to evaluate, and

% array of d base points b, if needed

%Output: value y of polynomial at x

function y=nest(d,c,x)

y=c(d+1);

for i=d:-1:1

y = y.\*x+c(i);

end

end

PROBLEM 2

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COMP

**1b**

clear;

clc;

format long;

% Initialization

x\_values = 10.^(-1:-1:-14);

orig\_results = zeros(size(x\_values));

alt\_results = zeros(size(x\_values));

correct\_digits = zeros(size(x\_values));

% Main computation loop

for i = 1:length(x\_values)

x = x\_values(i);

% Original expression

orig\_results(i) = (1 - (1 - x)^3) / x;

% Alternative expression after expanding cube of 1-x

alt\_results(i) = 3 - 3\*x + x^2;

% Calculate the number of correct digits

difference = abs(orig\_results(i) - alt\_results(i));

if difference == 0

correct\_digits(i) = Inf;

else

correct\_digits(i) = -log10(difference);

end

end

% Display results in a table

T = table(x\_values', orig\_results', alt\_results', correct\_digits', ...

'VariableNames', {'x', 'Original\_Expression', 'Alternative\_Expression', 'Correct\_Digits'});

disp(T);

**3**

clear;

clc;

a = -12345678987654321;

b = 123;

result = a + sqrt(a^2 + b^2);

% Now round the result to four significant digits

result\_rounded = round(result, 4, 'significant');

result\_alternate = -b^2/(a-sqrt(a^2 + b^2));

result\_alternate\_round = round(result\_alternate, 4, 'significant');

disp(num2str(result\_rounded));

disp(num2str(result\_alternate\_round));

PROBLEM 3

A close-up of a piece of paper

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COMP

1

clear;

clc;

%part a

f=@(x) x^3 -9 ;

a = bisect (f,2,3,0.00005);

disp(num2str(a));

%part c

y=@(x) cos(x)^2 + 6 - x;

c = bisect (y,6,7,0.00005);

disp(num2str(c));

%Program 1.1 Bisection Method

%Computes approximate solution of f(x)=0

%Input: function handle f; a,b such that f(a)\*f(b)<0,

% and tolerance tol

%Output: Approximate solution xc

function xc=bisect(f,a,b,tol)

if sign(f(a))\*sign(f(b)) >= 0

error("f(a)f(b)<0 not satisfied!") %ceases execution

end

fa=f(a);

fb=f(b);

while (b-a)/2>tol

c=(a+b)/2;

fc=f(c);

if fc == 0

%c is a solution, done

break

end

if sign(fc)\*sign(fa)<0 %a and c make the new interval

b=c;fb=fc;

else %c and b make the new interval

a=c;fa=fc;

end

end

xc=(a+b)/2;%new midpoint is best estimate

end