University of Asia Pacific

Department of Computer Science and Engineering

Course Title: Numerical Methods Lab

Course Code: CSE 314

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Question 1 Solve

My 3rd degree polynomial: x.^3 + 0.5*x.^2 - x + 0.25

Bisection Method Code:

```
bisection = @(x) x.^3 + 0.5*x.^2 - x + 0.25
x_l = 0;
x_u = 0.11;
array = [];
if bisection(x_l)*bisection(x_u) < 0
 for i = 1:10
 x_m = (x_l+x_u)/2;
 array(i) = double(x_m);
 if bisection(x_l)*bisection(x_m) < 0
 x_u = x_m;
 else
 x_l = x_m;
 endif
 endfor
else
 display("There is no Root");
end
display("Value of middle point in every iterations are: ");
display(array)
```

```
There is no Root
Value of middle point in every iterations are:
array = [](0x0)
>>
```

Newton Raphson Method Code:

```
f = @(x) x.^3 + 0.5*x.^2 - x + 0.25 %3rd degree ploynomial

dfdx = @(x) 3*x.^2 + x – 1 %1st differentiation

array = [];

array(1) = 0.05; %initial guess

for i = 1 : 9

  array(i+1) = array(i) - (f(array(i))/dfdx(array(i)));

end

display(array);
```

```
array =

   0.050000    0.263660    0.338362    0.362315    0.365936    0.366025    0.366025    0.366025    0.366025    0.366025

>>
```

Here for the above equation in bisection method it is not possible to find out the root of that polynomial. But if we apply the same equation in the Newton Raphson method, we can find the root of that polynomial.

Here we can see that in Newton Raphson method after some iterations the value is decreasing, so that it means that if we continue the iterations the result will get close to the root value.

Question 2 Solve:

Let, velocity find for the time 107s, x_find = 107

Linear Interpolation Code:

x = zeros(1, 2);

y = zeros(1, 2);

b = zeros(1, 2);

fprintf('Enter x(0) and f(x(0)) on separate lines: \n');

x(1) = input(' ');

y(1) = input(' ');

fprintf('Enter x(1) and f(x(1)) on separate lines: \n');

x(2) = input(' ');

y(2) = input(' ');

x_find = input('Now enter a point at which to evaluate the polynomial, x = ');

b(1) = y(1);

b(2) = (y(2) - y(1))/(x(2)-x(1));

fx0 = b(2) * (x_find - x(1)) + b(1);

fprintf('Newtons iterated value: %11.8f \n', fx0)

```
Enter x(0) and f(x(0)) on separate lines:
 95.5
 2799.901
Enter x(1) and f(x(1)) on separate lines:
 125.25
 3697.553
Now enter a point at which to evaluate the polynomial, x = 107
Newtons iterated value: 3146.89252941
```

Here,

x(1) = 95.5, y(1) = 1902.249

x(2) = 125.25, y(2) = 3697.553

x_find = 107

After all the calculation we will get the value of fx0 = 3146.8925941

Quadratic Interpolation Code:

```
x = zeros(1, 3);

y = zeros(1, 3);

b = zeros(1, 3);

fprintf('Enter x(0) and f(x(0)) on separate lines:  \n');

x(1) = input(' ');

y(1) = input(' ');

fprintf('Enter x(1) and f(x(1)) on separate lines:  \n');

x(2) = input(' ');

y(2) = input(' ');

fprintf('Enter x(2) and f(x(2)) on separate lines:  \n');

x(3) = input(' ');

y(3) = input(' ');

x_find = input('Now enter a point at which to evaluate the polynomial, x = ');

b(1) = y(1);

b(2) = (y(2) - y(1))/(x(2)-x(1));

b(3) = ((y(3) - y(2))/(x(3)-x(2)) - b(2))/(x(3) - x(1));

fx0 = b(1) + b(2) * (x_find - x(1)) + b(3) * (x_find - x(1)) * (x_find - x(2));

fprintf('Newtons iterated value: %11.8f \n', fx0)
```

```
Enter x(0) and f(x(0)) on separate lines:
 65.75
 1902.249
Enter x(1) and f(x(1)) on separate lines:
 95.5
 2799.901
Enter x(2) and f(x(2)) on separate lines:
 125.25
 3697.553
Now enter a point at which to evaluate the polynomial, x = 107
Newtons iterated value: 3146.89252941
```

Here,

x(1) = 95.5, y(1) = 1902.249

x(2) = 95.5, y(2) = 1902.249

x(3) = 125.25, y(3) = 3697.553

x_find = 107

After all the calculation we will get the value of fx0 = 3146.8925941

Here we consider the Newton's Divided Difference Method. And in this method, we use Linear & Quadratic Interpolation, for finding the velocity of x_find = 107s

So, we can see that for the both interpolation the result is same for 107s, which is 3146.8925941 ms^{-1}