Q1 >> An algorithm is a procedure that describes, in an unambiguous manner, a finite sequence of steps to be performed in a specific order.

>> An algorithm that satisfies this property is called stable; otherwise, it is unstable. Some algorithms are stable only for certain choices of initial data and are called conditionally stable. We will characterize the stability properties of algorithms whenever possible. This are all are methods of algorithms:-

1. Bisection Method

2. Method of False Position (Regular False Method)

3. Newton Raphson Method (Newton’s method)

4. Successive Approximation Method (Iteration method).

5. Secant method

2, List the similarity and difference between all methods?

 The difference

 >>Bisection method

##  is based on the repeated application of the intermediate value theorem

## is also known as the interval halving method

##  is not the fastest method available for finding roots of a function, but it is the most reliable method

## Will always close in on it.

## We assume that f(x) is a function that is real-valued function. Suppose that f(X) is continuous an interval a<x<b and f(a) f(b)<0 . When this is the case f(x), will have opposite signs at the end points of the interval (a, b).



>>Method of false position

## In this method, we choose two points X0 and X1 such that f(X0) and f(x1) are of opposite signs. Since the graph y=f(x) of crosses the x-axis between these two points, a root must lie in between these points. Consequently, f(X0)f(X1)<0. Equation of the line joining points (X0, f(X0)) and (X1,f(X1)) is given by

 

###  The point of intersection of this line with the x-axis is taken as the next approximation to the root. Setting Y=0 and replace X by X2 , we get

 : 

## The value X2 of can also be put in the following form:

 



>>Newton Raphson Method (Newton’s method)

Newton’s method is an extremely powerful technique, but it has a major weakness; the need to know the value of the derivative of f at each approximation.

>Frequently, f0(x) is far more diﬃcult and needs more arithmetic operations to calculate than f (x).

>Hard to ﬁnd starting points (Unknown basin of attraction) Newton Raphson formula is the point of intersection of the tangent line through the point ( Xn, f (Xn) ) with the x-axis. The process is repeated until the required accuracy is obtained.

 

 >>Successive Approximation Method (Iteration method).

This method is also known as the direct substitution method or method of fixed iterations. To find the root of the equation f(x) = 0 by successive approximations, we rewrite the given equation in the form

 X=g(x)

Now, first we assume the approximate value of root (let X0 ) , then substitute it in g(x) to have a first approximation X1 given by

 X1=g(X0)

Similarly, the second approximation X2 is given by

 X2=g(X1)

In general,

 Xn+1=g(X)

>>Secant method

>The secant method is a variant of Newton’s method, where f0 (xn) is replaced by its ﬁnite diﬀerence approximation based on the evaluated function values at xn and at the previous iterate xn−1.

>Assuming convergence, observe that near the root

 f0 (xn) ≈ f (xn) −f (xn−1)/ xn −xn−1

>Substitution of this approximation into the formula for Newton’s method yields the Secant method,

Xn+1 =

F (xn) (xn −xn−1) f ( xn)−f (xn−1)

, n = 0,1,2,3, ···

The basic similarity of all methods?

> All of the methods to determine of Root

> The error decreases slowly at ﬁrst but then rapidly after a few iterations

> The method is guaranteed to converge