Military Institute of Science and Technology

Department of Computer Science & Engineering

Subject: Numerical Methods Sessional (**CSE 214)**

Exp. No.-1 **Date-**15th July, 2019

Name of the Exp.: Solution of Nonlinear Equation by Numerical Method using Method of False Position (Regula Falsi Method).

Introduction:

In scientific and engineering work, a frequently occurring problem is to find the roots of equations of the form $y = f(x) = 0$, i.e finding the value of x where the value of $y = f(x)$ is equal to 0. In quadratic, cubic or biquadratic equations, algebraic formulae are available for expressing the roots in terms of co-efficient. But in the case, where f(x) is a polynomial of higher degree or an expression involving transcendental functions, the algebraic methods are not applicable and the help of numerical method must be taken to find approximate roots.

Objective:

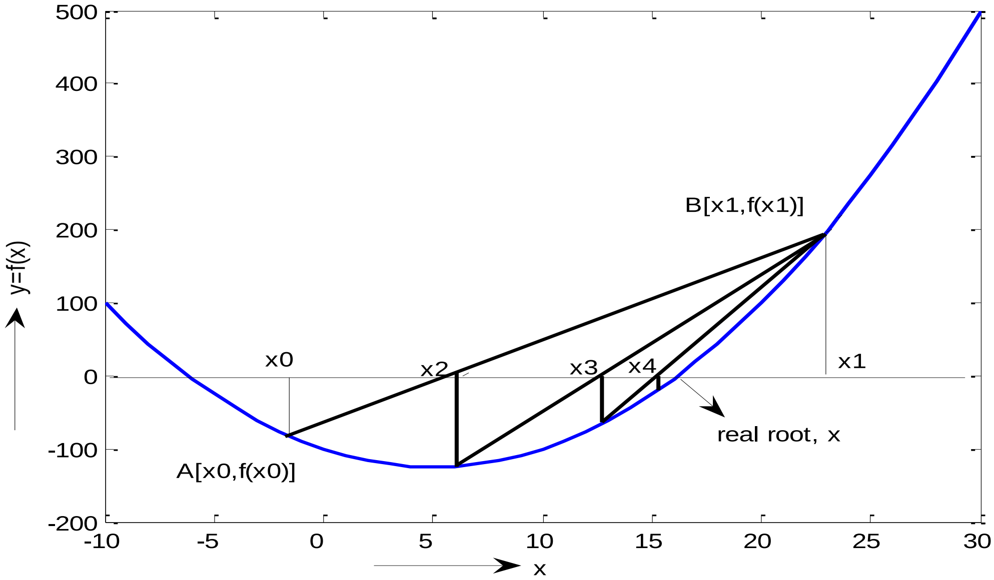
- ✓ To write a program in order to find out the roots of a nonlinear equation by the method of False Position.

Theory:

Method of False Position is the oldest method for finding the real root of an equation, and closely resembles the bisection method. In this method, we choose two points x_0 and x_1 such that $f(x_0)$ and $f(x_1)$ are of opposite signs. Since the graph of $y = f(x)$ crosses the $x-$axis between these two points, a root must lie in between these points. Now, the equation of the chord joining the two points, A$[x_0, f(x_0)]$ and B$[x_1, f(x_1)]$ is:

$$\frac{y - f(x_0)}{x - x_0} = \frac{f(x_1) - f(x_0)}{x_1 - x_0} \quad ----(1)$$

Fig.1



The method consists in replacing the part of the curve between the points $A[x_0, f(x_0)]$ and $B[x_1, f(x_1)]$ by means of the chord joining these points, and taking the point of intersection of the chord with the $x-$axis as an approximation to the root. The point of intersection in the present case is given by putting $y = 0$ in (1).Thus, we obtain

$$x = x_0 - \frac{f(x_0)}{f(x_1) - f(x_0)}(x_1 - x_0) - - - - - (2)$$

Hence the second approximation to the root of $f(x) = 0$ is given by

$$x_2 = x_0 - \frac{f(x_0)}{f(x_1) - f(x_0)}(x_1 - x_0) - - - - - (3) \text{ [Fig.-1]}$$

If now $f(x_2)$ and $f(x_0)$ are of opposite signs, then the root lies between x_0 and x_2 ,and we replace x_1 by x_2 in (3), and obtain the next approximation. Otherwise, we replace x_0 by x_2 and generate the next approximation. The Procedure is repeated till the root is obtained to the desired accuracy. Fig.-1 gives a graphical representation of the method.

Problems:

1. Write programs to find the real root of the following equations by the Method of False Position:

   a) $f(x) = x^3 - 4x + 1$; correct to 5decimal point, between x=0 and x=1.
   b) $3x+\sin x = e^x$; correct to 5decimal point, between x=0 and x=1.
   c) $x\log_{10}x = 1.2$; correct to 5decimal point, between x=2 and x=3.

Reference Book:

1) Numerical Methods for engineers-by Chapra/Kanal
2) Numerical Methods in Science and Engineering by Dr. Sudhir K. Pundir