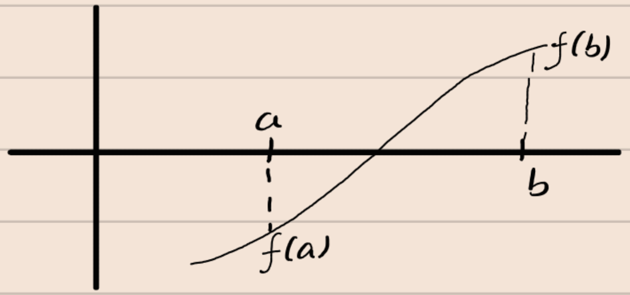
Session Timings :- Tuesday & Wednesday 3:00PM – 5:00 PM

LH XXX & 503

Finding Roots of an Equation :-

① Bracketing Methods

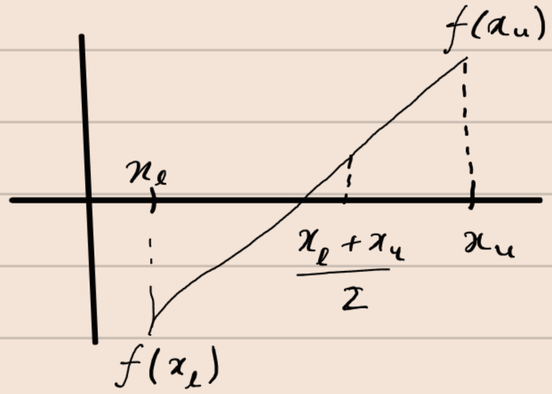


Let f be a continuous real valued function.

$f(a)f(b) < 0$ then f has a root in $[a,b]$

(i) Bisection Method :-

let x_l and x_u be st



1. $f(x_l)f(x_u) < 0$
2. $x_r = \dfrac{x_l + x_u}{2}$
3. If $f(x_r)f(x_u) < 0$, put $x_l = x_r$, go to step 2
4. If $f(x_r)f(x_l) < 0$, put $x_u = x_r$, go to step 2
5. If $f(x_r)f(x_l) = 0$, report x_r as root.

Approximate % relative error :-

$$\varepsilon_a = \left| \frac{x_r^{new} - x_r^{old}}{x_r^{new}} \right| \times 100\%$$

x_r^{new} :- x_r of current iteration

x_r^{old} :- x_r of previous iteration

$$\Delta x = x_u - x_l$$

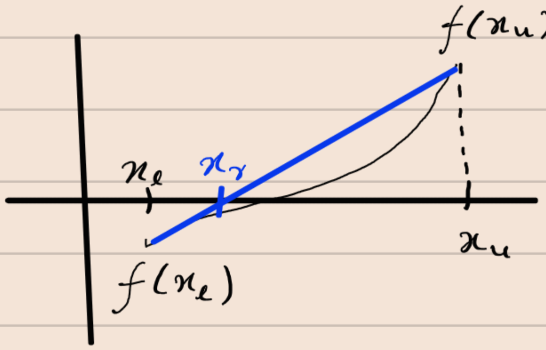
error absolute $\leq \dfrac{\Delta x}{2}$ $\qquad x_r \pm \dfrac{\Delta x}{2}$

initial values of x_u, x_l

After n-iterations absolute error $\leq \dfrac{x_u^0 - x_l^0}{2^n}$

(ii) False Position :-

$$f(x_l) \cdot f(x_u) < 0$$



$$\frac{f(x_l)}{x_r - x_l} = \frac{f(x_u)}{x_r - x_u}$$

$$\Rightarrow x_r f(x_l) - x_u f(x_l) = x_r f(x_u) - x_l f(x_u)$$

$$\boxed{x_r = \frac{x_u f(x_l) - x_l f(x_u)}{f(x_l) - f(x_u)}}$$

$$x_r = x_u + \frac{x_u f(x_l)}{f(x_l) - f(x_u)} - x_u - \frac{x_l f(x_u)}{f(x_l) - f(x_u)}$$

$$x_r = x_u + \frac{x_u f(x_u)}{f(x_l) - f(x_u)} - \frac{x_l f(x_u)}{f(x_l) - f(x_u)}$$

$$\boxed{x_r = x_u - \frac{f(x_u)\,[x_l - x_u]}{f(x_l) - f(x_u)}}$$