Unrestricted Method (search) Method with fixed step-length.

Step 1: start with an initial guess point x_i, $(i=1)$

Step-2: Obtain the new approximation $x_{i+1} = x_i + \lambda_i s_i$

Note $s_i = +1$ or -1, $\lambda_i = \lambda$ $\forall$ steps.

Step-3: If $f(x_i) > f(x_{i+1})$, repeat step-2 with

$\boxed{x_{i+1} = x_i + \lambda}$ $\quad s_i = +1$

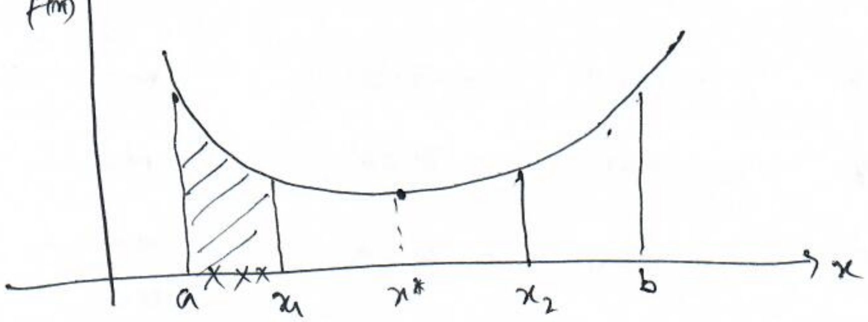
until $f(x_{i+1}) > f(x_i)$

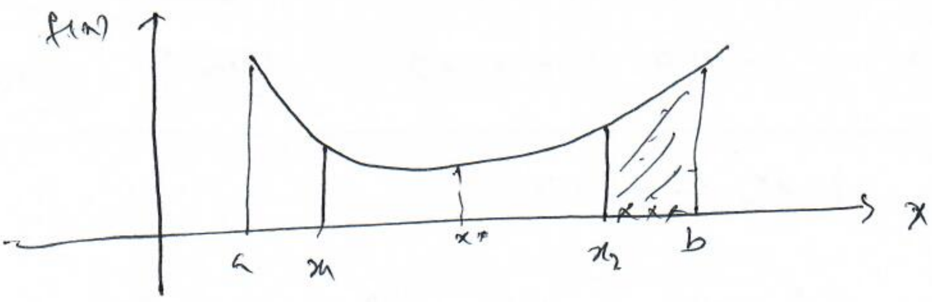
if $f(x_i) < f(x_{i+1})$, repeat step-2 with $s_i = -1$

until $f(x_{i+1}) < f(x_i)$.

$\boxed{x_{i+1} = x_i - \lambda.}$

if $f(x_i) = f(x_{i+1})$ the minimum is within (x_i, x_{i+1}).





<u>Example</u> :- Minimize $f(x) = x(x-4)$, $x \in [0, 4]$

Given the function is unimodal, start with $x = 1$ and step. size $\lambda = 0.1$.

$f(1) = -3$

$f(0.9) = -2.79$,

$f(1.1) = -3.19$.

$\therefore$ Minimum must lie within $[1, 4]$

i	x_i	x_{i+1}	$f(x_i)$	$f(x_{i+1})$	$f(x_i) < f(x_{i+1})$?
1	1.0	1.1	−3	−3.19	No
2	1.1	1.2	−3.19	−3.36	No
3	1.2	1.3	−3.36	−3.51	No
4	1.3	1.4	−3.51	−3.64	NO
5	1.4	1.5	−3.64	−3.84	NO
6	1.5	1.6	−3.84	−3.91	NO
7	1.6	1.7	−3.91	−3.96	NO
8	1.7	1.8	−3.96	−3.99	No
9	1.8	1.9	−3.99	−4.0	No.
10	1.9	2.0	−4.0	−3.99	$\boxed{\text{Yes}}$ $\boxed{\text{STOP}}$

$x^* = 1.9$, $f(x^*) = -4.0$

<u>Note</u> :- The process of checking $f(x_i) < f(x_{i+1})$ will be $f(x_i) > f(x_{i+1})$ for Maximization problem.

VII Advantage and Disadvantage :-

(i) Main Advantage of this process is easy to implement. This Method converge very small number of iteration to get the optimal solution,

(ii) Main disadvantage is that selection of the initial guess point. If we randomly choose the initial guess then there may need more number of iteration to get the optimal solution. Therefore, selection of iteration point (initial guess) is more important.

(iii) Further, selection of step length may lead to much more iteration or even we can not find the optimal solution by selecting wrong step size (length) (Biger step-length)

To overcome such situation we use unrestricted search with accelerated step-length.

(B) step size can be doubled, or tripled or more as long as the functional value is improving.

i	λ	x_i	x_{i+1}	$f(x_i)$	$f(x_{i+1})$	$f(x_i) < f(x_{i+1})$?
1	0.1	1.0	1.1	−3	−3.19	No
2	0.2	1.1	1.3	−3.19	−3.51	No
3	0.3	1.3	1.6	−3.51	−3.91	No
4	0.4	1.6	2.0	−3.91	−4.0	No
5	0.5	2.0	2.5	−4.0	−3.75	$\boxed{\text{Yes}}$