Entrance Exam Report

Bryan Estrada Chiang

1/18/2026

A Find Minimum Value

To look for the minimum value of a function $f(x)$, where $x \in (1, 2)$, basically, we look for the `middle` point between the endpoitns of the interval. Then, my algorithm determines the behavior of $f(x)$ around `middle`. If $f(x)$ decreases by moving `tol` along x-axis either left or right, then the interval to look in that minimum value of $f(x)$ changes from $\pm$`tol` to the other closest endpoint of the interval. The algorithm keeps iterating until the distance from the endpoints of the interval along x-axis is $\leq$ `tol`. In other words, let $d = |x_i - x_j|$ be the distance of the two endpoints of the interval where the minimum point of $f(x)$ sits for all $j \leq i$, so the algorithm stops when $d \leq$`tol`.

Notice to calculate `middle`, we divide d by half. So, let i be the number of times we divide d until $d \leq$`tol`. When found the minimum value of $f(x)$, the distance would be:

$$\begin{aligned} \frac{d}{2^i} &\leq \texttt{tol} \\ 2^i &\geq \frac{d}{\texttt{tol}} \\ \log 2^i &\geq \log \frac{d}{\texttt{tol}} \\ i &\geq \log \frac{d}{\texttt{tol}} \end{aligned}$$

Thus, my algorithm performs $\Omega\left(\log \frac{d}{\texttt{tol}}\right)$ times.