
Group Exercise 3: Bisection Method

CPSC 302: Numerical Computation for Algebraic Problems

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Outline

1. Outcome
2. Applications
3. Problem Setting

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Today's Goal

Practices and further insight on the first method we learned for solving basic, simply stated nonlinear problems.

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Applications of Nonlinear Equations in One Variable

Projectile motion: An artillery officer wants to fire his cannon on an enemy brigade camped d meters away. At what angle θ to the horizontal should he aim the cannon in order to strike the target?

$$f(\theta) = \frac{2v_0^2 \sin(\theta) \cos(\theta)}{g} - d = 0$$

Applications of Nonlinear Equations in One Variable

Financial mathematics: Problems involving loans, interest rates, and savings.

Suppose you borrow \$100,000 to buy a house (not in Vancouver!). Each month you are willing to pay p dollars, and the loan is to be paid off in 30 years (360 months). You might ask at what interest rate you can afford the loan.

$$g(r) = 100,000r - \frac{(1+r)^{360}}{(1+r)^{360} - 1} = 0$$

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Setting

Consider the scalar, nonlinear equation $f(x) = 0$, where f is continuous on the interval $[a, b]$. We denote a solution of the equation by x^* .

Assume that f changes sign on $[a, b]$, i.e., $f(a) \cdot f(b) < 0$.

We apply the bisection method starting with the interval $[a, b]$. Let x_k be an approximation to x^* obtained after k steps of the bisection method. x_k is the midpoint of the k th subinterval trapping the root.