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# Numerical Analysis

Math 370 Fall 1998  
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MWF 11:30am - 12:25pm  
Fowler 127

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*Class 12: Wednesday September 30*

**SUMMARY** Analyzing Root Finding Algorithms: Bisection

**READING** Burden & Faires, 47–54

## General Root-Finding Algorithm

1. Plot the function, in order to get an initial guess for the root and to check for problems
2. Select an initial guess [or bracket ]
3. Iteratively refine your initial guess
4. Decide you are "converged"
5. Stop

### **demobisect.m**

There is another implementation of Bisection Algorithm in `q:/mfiles/math370/demobise.m`

Modify this m-file to find the root of  $f(d) = 2552 - 30d^2 + d^3$

How many steps does it take to converge? Using what initial bracket?

## Analyzing Convergence of Bisection

Write down an expression for the size of  $|b_n - a_n|$  which depends on  $b - a$  and the  $n$ -th iterate (note:  $|b_0 - a_0| = b - a$ )

Solve this formula for  $n$ .

Try and predict how many iterations it will take Bisection to find the zero of  $f(x) = \log(x) - 5 + x$  on the interval  $[1,9]$  to 5 decimal places

Go to the computer and see how many iterations **demobisect.m** actually takes to converge. Explain.

## Convergence Criteria

There are a number of different ways to consider that a method has “converged”

There is convergence criteria on  $f(x)$  and convergence criteria on  $x$

### Question

There is also relative convergence versus absolute convergence. Which do you think is the “best” method of assessing convergence?