Lab 3 Help - Bisection

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- Assume we have a problem in the form:

$$y = f(x)$$

- The question is "find the value of x that produces a value y from some function, f"

- Bisection starts with a wide range of x, and systematically splits that range down by half each time to converge onto the value of x that gives y

- The general bisection algorithm can be complicated, so to make things simple, let's assume at increasing function

- We need to find where y=f(x)

- Normally do this to within some tolerance to avoid infinite loop:
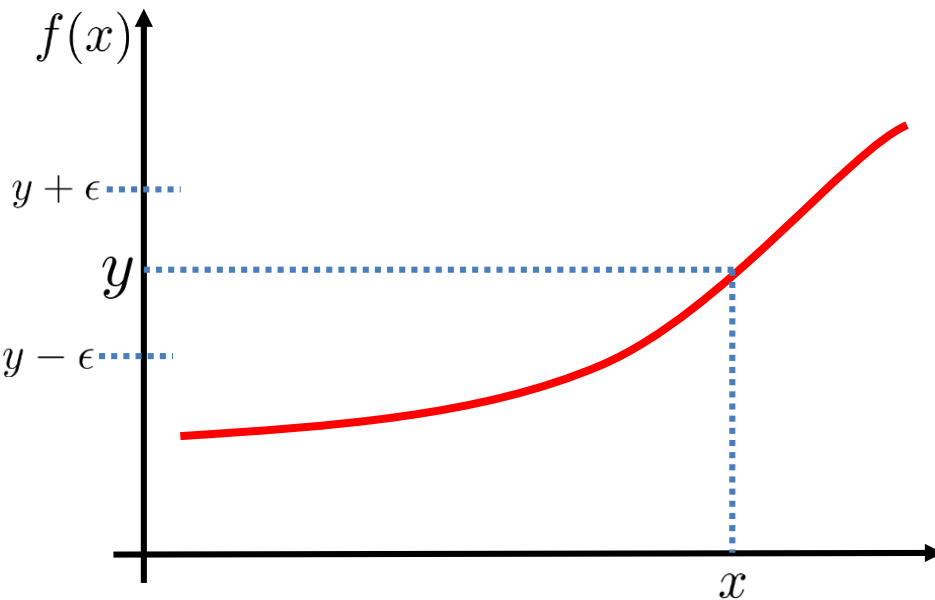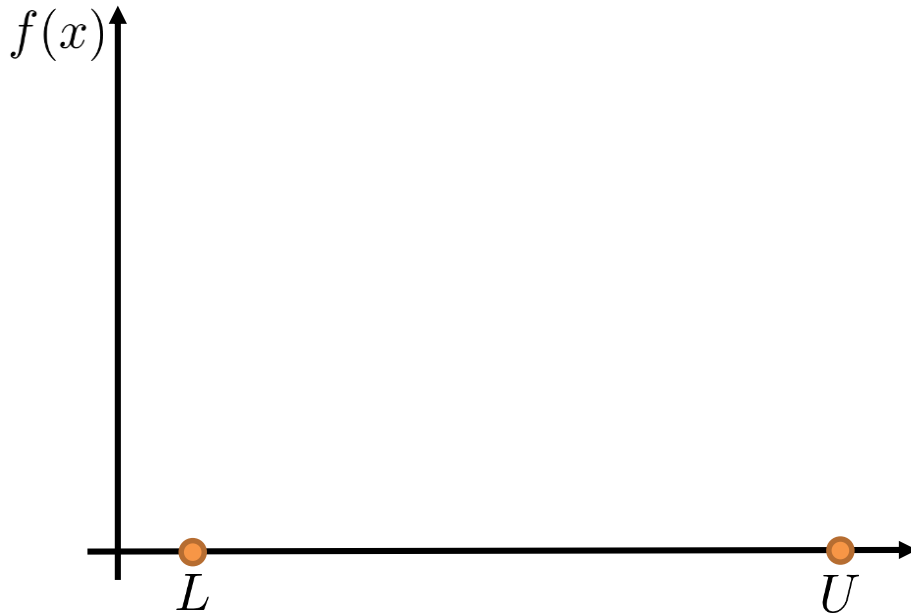
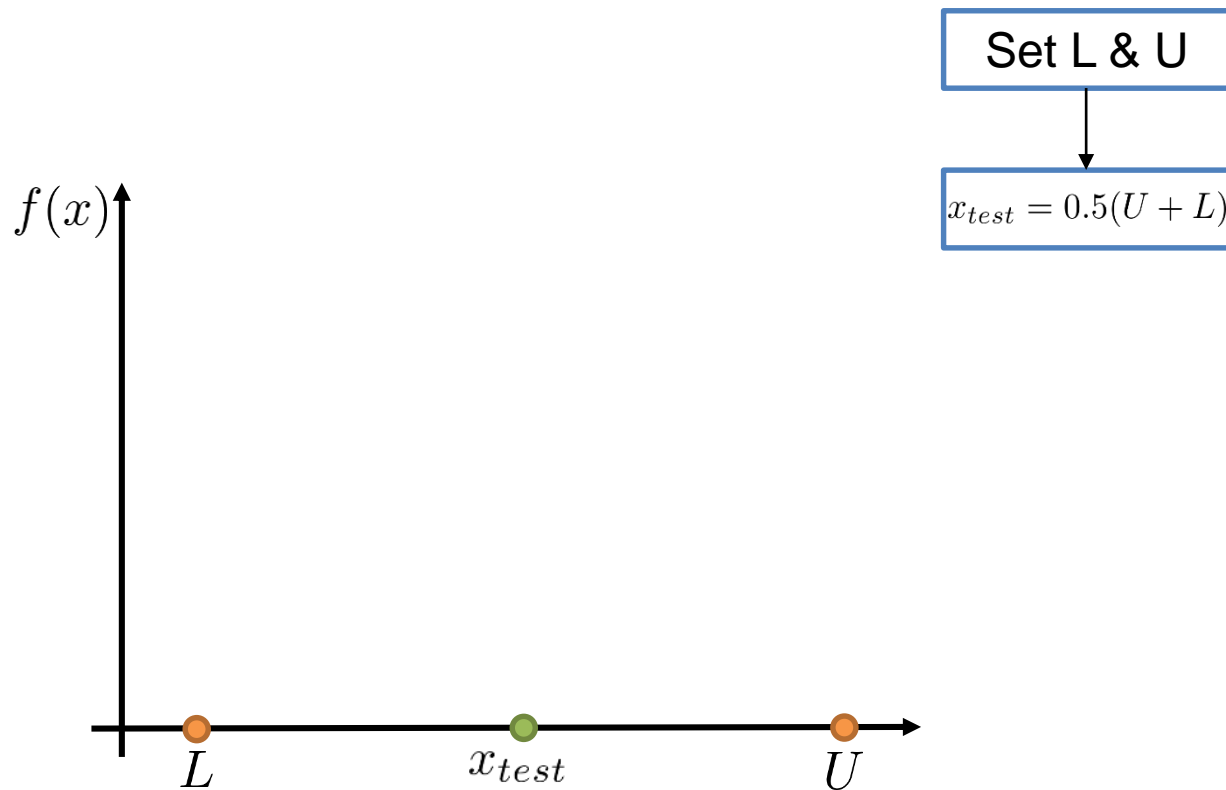$$y - \epsilon \leq f(x) \leq y + \epsilon$$

The algorithm progresses thus:

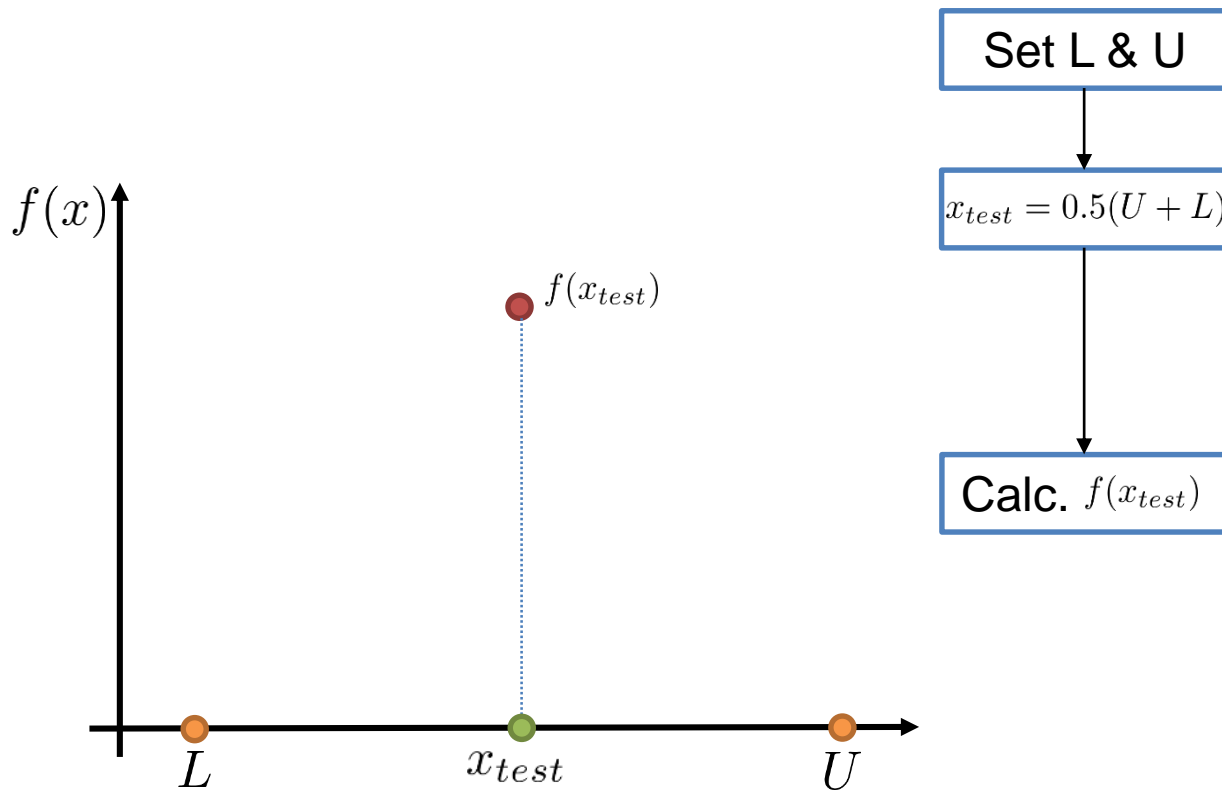- Set initial values for lower and upper bounds

Set L & U

$f(x)$

L U

The algorithm progresses thus:
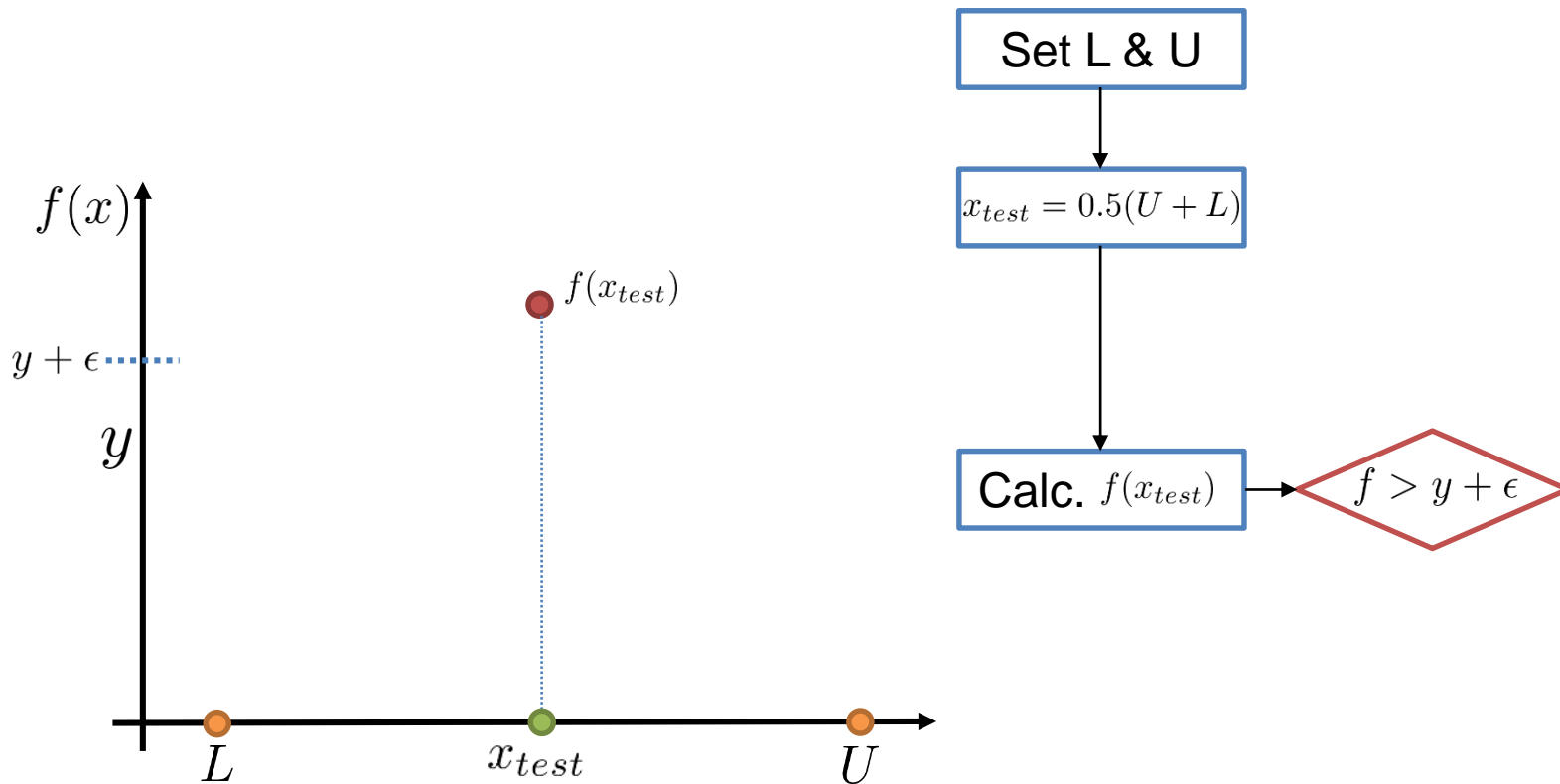
- Calculate test point half way between lower and upper

Set L & U

$x_{test} = 0.5(U + L)$

$f(x)$

L x_{test} U

The algorithm progresses thus:

- Evaluate function value at the test point

$f(x)$

$f(x_{test})$

L x_{test} U
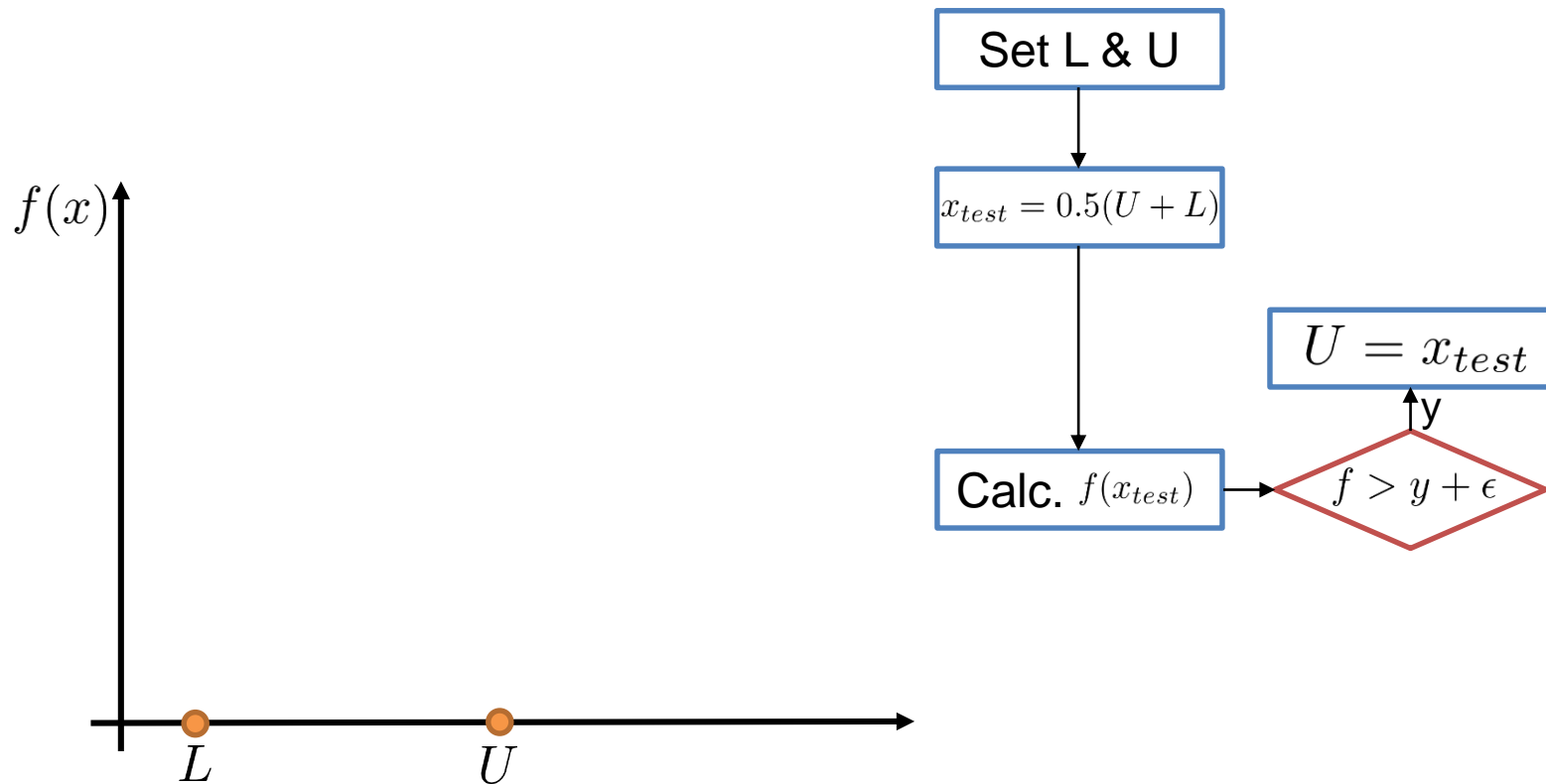
Set L & U

$x_{test} = 0.5(U + L)$

Calc. $f(x_{test})$

The algorithm progresses thus:

- Is f(xtest) above allowable range of y?

The algorithm progresses thus:

- If above range of y, then upper is too high, so bring upper down

$f(x)$

L U

Set L & U

$x_{test} = 0.5(U + L)$
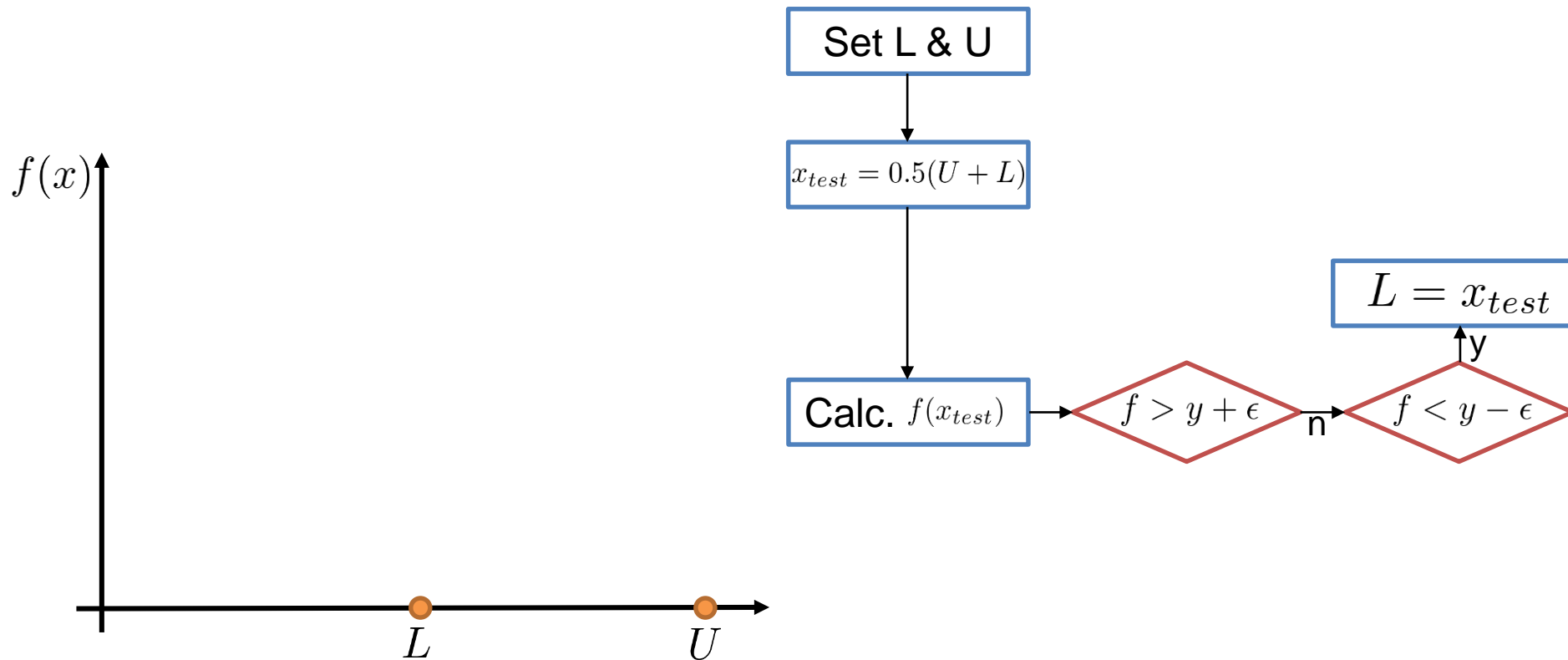
$U = x_{test}$

y

Calc. $f(x_{test})$ → $f > y + \epsilon$

The algorithm progresses thus:
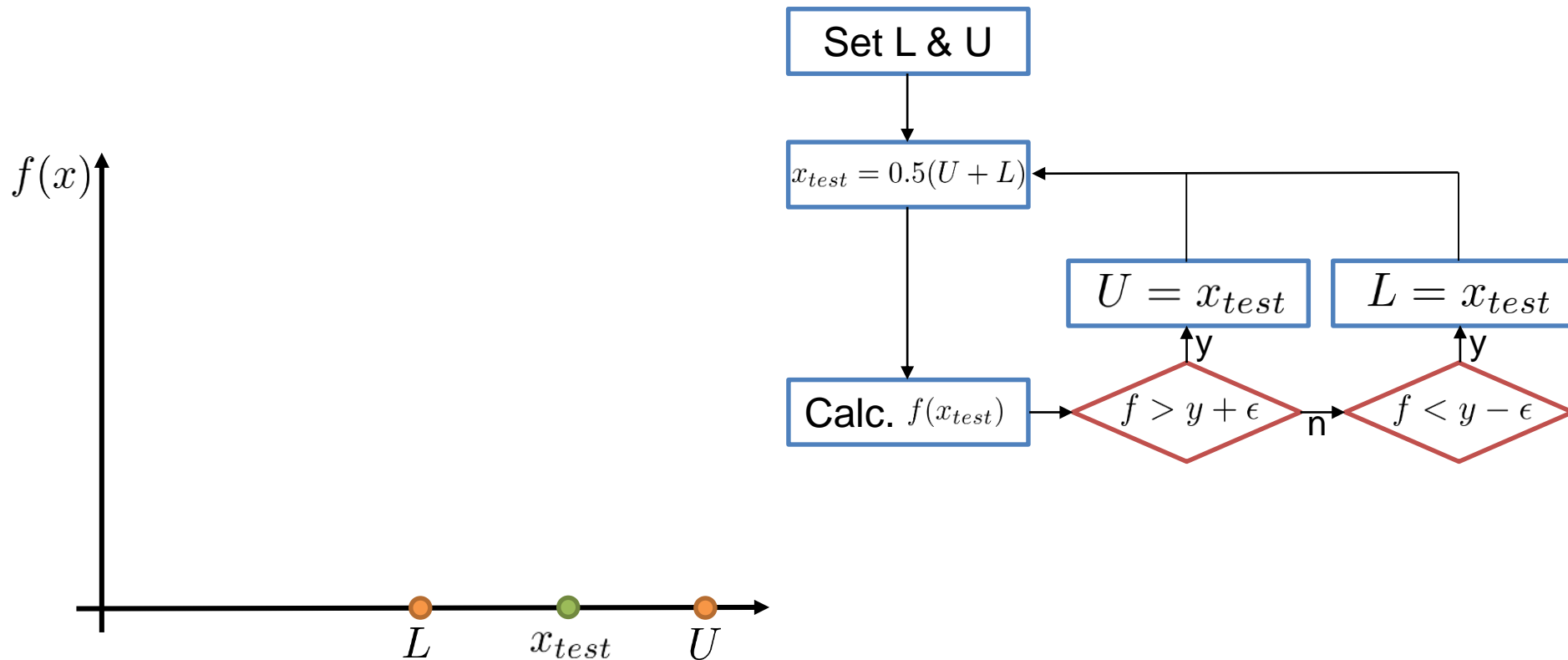
- If not, then is f(xtest) below allowable range of y?
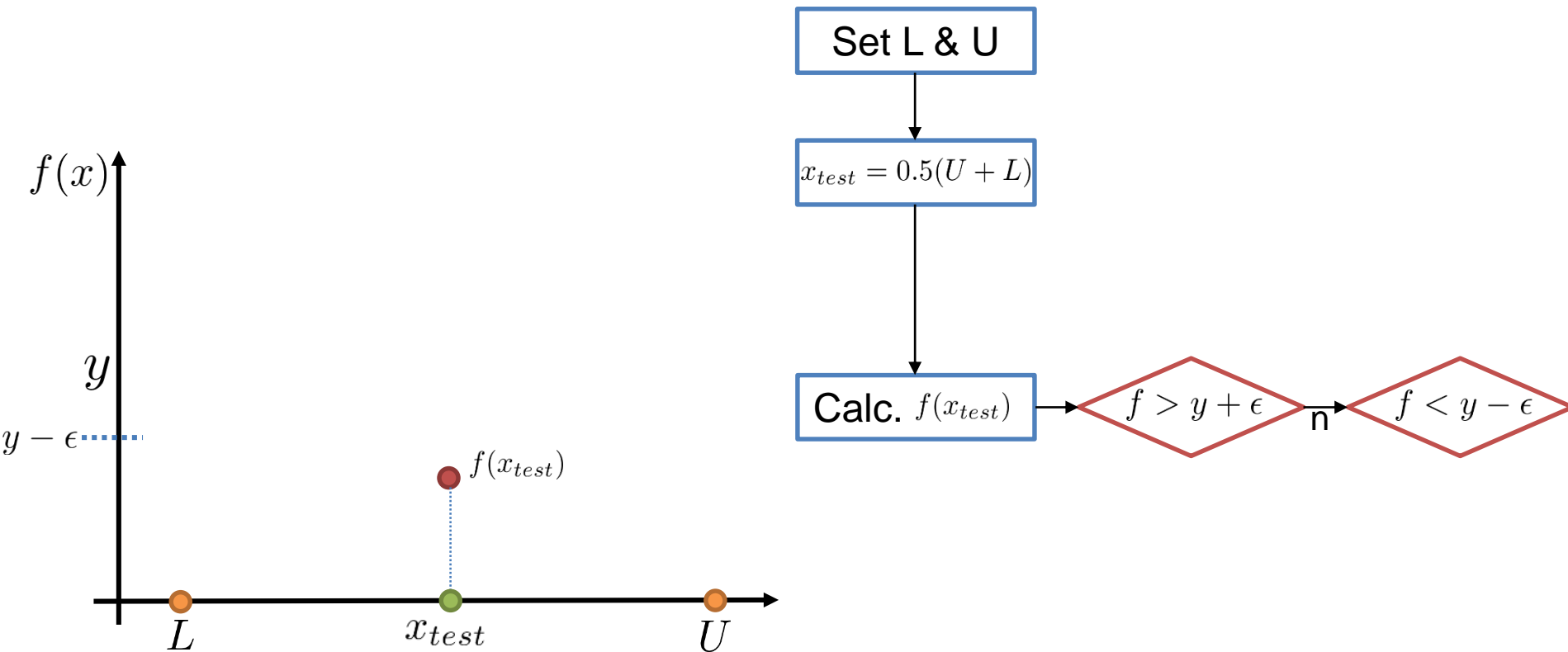
The algorithm progresses thus:

- If below range of y, then lower is too low, so bring lower up

The algorithm progresses thus:

- Repeat

The algorithm progresses thus:

- If f is between the bounds, then the solution has been found to within the required tolerance