Iclicker question

You are tasked with measuring the height of a tree and you get the measurement as 170 ft tall. You later realized that your measurement tools are somewhat faulty, up to a relative error of 10%. What is the minimum height of the tree (numbers rounded to 3 sig figs) ?

A) 153 ft

B) 155 ft

C) 187 ft

D) 189 ft

$\hat{x} = 170 \text{ ft}$

$e_r = 0.1$

$e_r = \frac{|x - \hat{x}|}{|x|} \longrightarrow e_r x = |x - \hat{x}|$

$$\begin{cases} \hat{x} = x(1 - e_r) \\ \hat{x} = x(1 + e_r) \end{cases}$$

$x = \frac{\hat{x}}{(1 - e_r)}$ or $x = \frac{\hat{x}}{(1 + e_r)}$

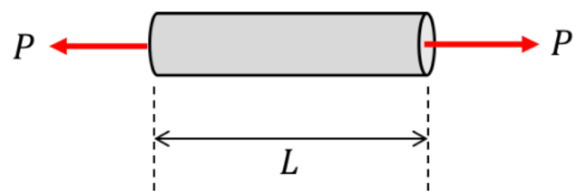
$x = \frac{170}{1.1} = 154.545$

$x = 155 \text{ ft}$

For the circular rod below, we can determine the change in the length L as

$$\delta = \frac{FL}{EA}$$

where $F = 38 \times 10^3$ N is the force, $L = 1$ m is the length of the bar, $A = 19 \times 10^{-6}\mathrm{m}^2$ is the circular cross section area, and $E = 105 \times 10^9 \mathrm{N/m}^2$ is a material property.



What is the value of δ?

$\delta =$	number (rtol=0.001, atol=1e-08)	m	?

relative error

$\text{rtol} = 10^{-3} \longrightarrow e_r \leq 10^{-3} = 10^{-n+1}$

$\boxed{\text{hence } n = 4}$

Select all of the options that will give you the correct answer above

- [x] A) 0.01904761904761905
- [ ] B) 0.019
- [ ] C) 0.0190
- [x] D) 0.01905
- [x] E) 0.019048

→ the approximated answers should have <u>at least</u> 4 significant digits!

Iclicker question

Matrix Norm Approximation

Suppose you know that for a given matrix A three vectors $\mathbf{x}$, $\mathbf{y}$, $\mathbf{z}$ for the vector norm $||\cdot||$,

$||\mathbf{x}|| = 2$, $||\mathbf{y}|| = 1$, $||\mathbf{z}|| = 3$,

and for corresponding induced matrix norm,

$||A\mathbf{x}|| = 20$, $||A\mathbf{y}|| = 5$, $||A\mathbf{z}|| = 90$.

What is the largest lower bound for $||A||$ that you can derive from these values?

a) 90
b) 30
c) 20
d) 10
e) 5

$$\|A\|_p = \max\left\{ \frac{\|Ax\|}{\|x\|}, \frac{\|Ay\|}{\|y\|}, \frac{\|Az\|}{\|z\|} \right\}$$

$$= \max\{10, 5, 30\} = 30 \,//$$

Iclicker question

Suppose you have $\boldsymbol{A} = \boldsymbol{U}\,\boldsymbol{\Sigma}\,\boldsymbol{V}^{\boldsymbol{T}}\boldsymbol{x}$ calculated. What is the cost of solving

$$\min_{\boldsymbol{x}} \|\boldsymbol{b} - \boldsymbol{A}\,\boldsymbol{x}\|_2^2 \,? \qquad x = V\,\Sigma_R^T\,U_R^T\,b$$

$$z = U_R^T b = \begin{bmatrix} u_1^T b \\ u_2^T b \\ \vdots \\ u_n^T b \end{bmatrix} \quad O(m) \ldots O(m) \;\Rightarrow\; O(mn)$$

$n \times m \quad m \times 1$

A) $O(n)$
B) $O(n^2)$
$\boxed{\text{C) } O(mn)}$
D) $O(m)$
E) $O(m^2)$

$$y = \Sigma_R^T z = \underbrace{\begin{bmatrix} \ddots \end{bmatrix}}_{n \times n} \underbrace{\begin{bmatrix} z \end{bmatrix}}_{n \times 1} = O \to O(n) \quad \text{diagonal !!}$$

$$x = Vy = \begin{bmatrix} v_1 & v_2 & \cdots & v_n \end{bmatrix} \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} \to O(n^2)$$

since $\underline{\underline{m > n}}$

$O(mn)$

Iclicker question

Mark the incorrect statement about the Bisection Method:

False

A) Has linear convergence True

B) Requires two function evaluations for each iteration, i.e. $f(a)$ and $f(b)$

C) The function must be continuous with a root in the interval $[a, b]$ True

D) Given the initial internal $[a, b]$, the length of the interval after k iterations is $\frac{b-a}{2^k}$ True

only at first iteration we have two function evaluations, then only one function evaluation per iteration is needed.

CONTINUE DEMO