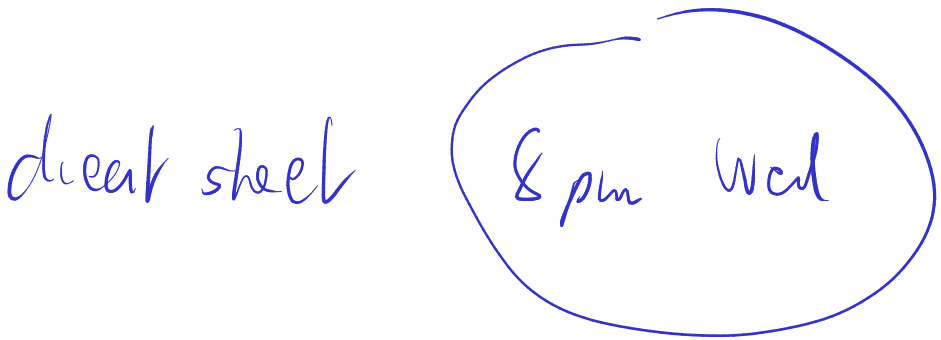
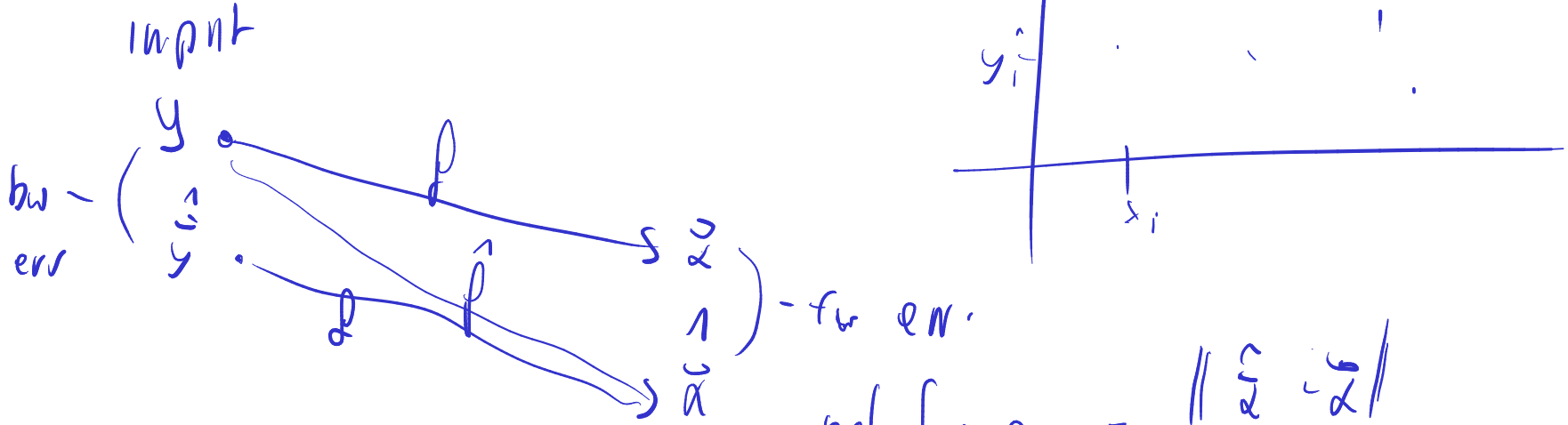
Announcements

- HW10 due Dec 18
  - If current planning holds up, problem 2 may be useful for the final
- Final starts Thursday
  - Up to, but not including Richardson
- Please fill out ICES (will take a few minutes at end)
  - Helps me justify effort I put towards CS450



Outline

What does backward stability of the linear solve mean for interpolation?



$$\text{rel fw err.} = \frac{\|\hat{\alpha} - \alpha\|}{\|\alpha\|}$$

$$\underset{\text{rel}}{\text{fw}} \leq \underset{\text{abs}}{\kappa} \cdot \underset{\text{abs}}{\text{bw}}_{\text{rel}}$$

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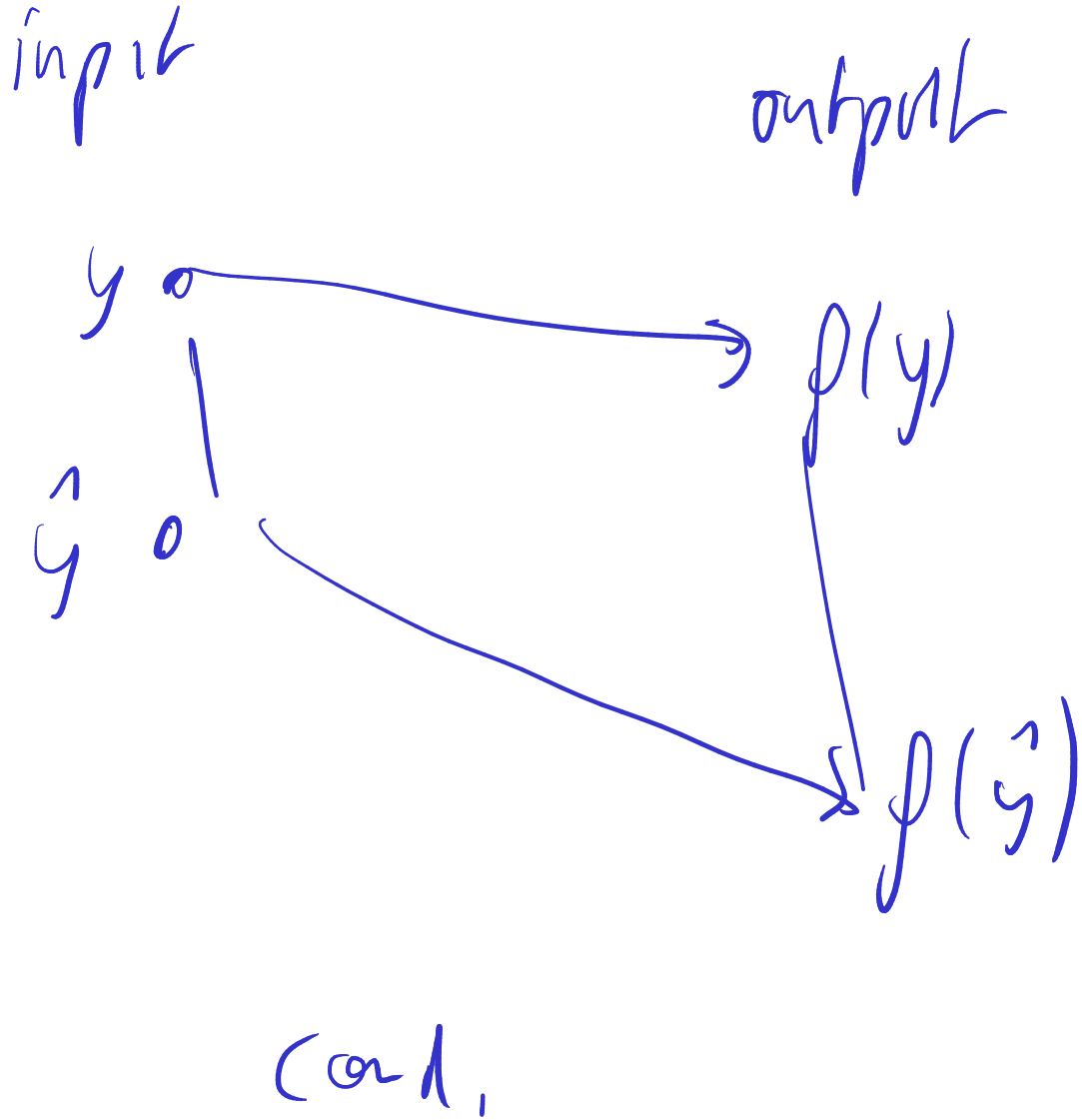

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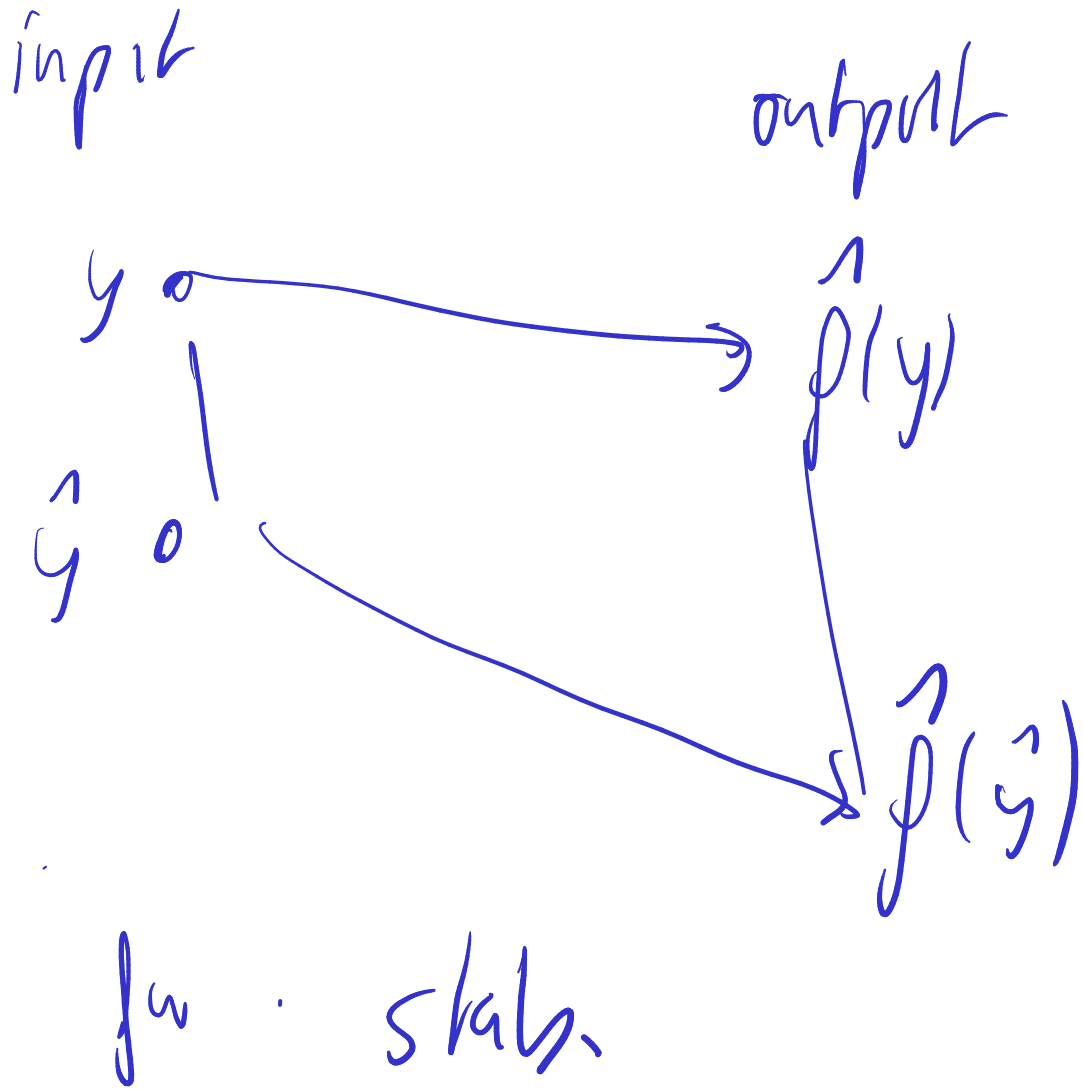

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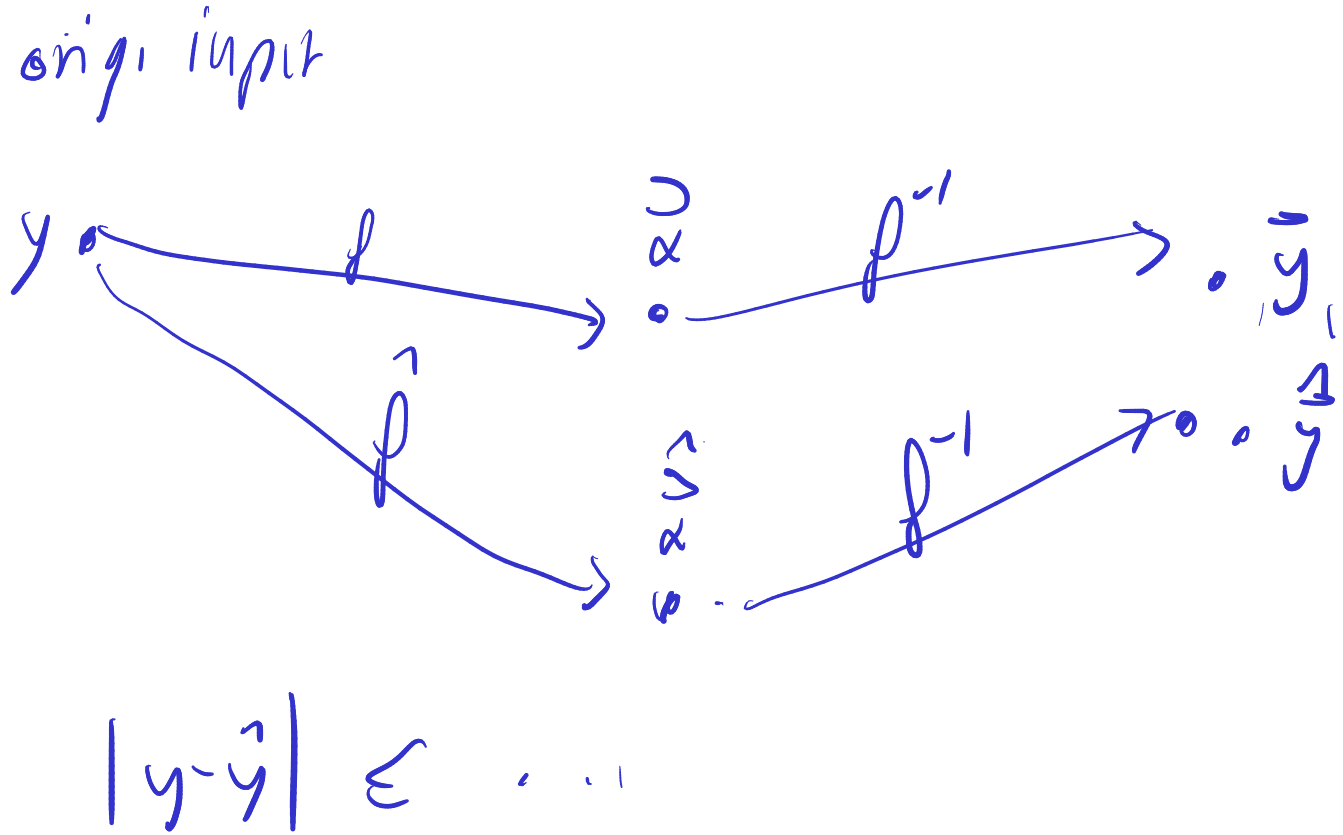


What does backward stability of the linear solve mean for interpolation?

backward err. in lin. system solve:

"residual"

Forward stability:

fw perturbation α

< "stab." bw perturbation $\tilde{y}$

can be obtained from

bw err bound chained w/ cond.

What does backward stability of the linear solve mean for interpolation?

backward stability:

What does backward stability of the linear solve mean for interpolation?

Name every thing Gauss!

- Gauss-Newton
- Gauss elim
- Gauss Jordan
- Gauss quad.

To get an equivalent increase in the range of magnitudes provided by subnormals, how many more exp. bits?

DP.

+52 stored

(53)

+11 exp

+1 sign

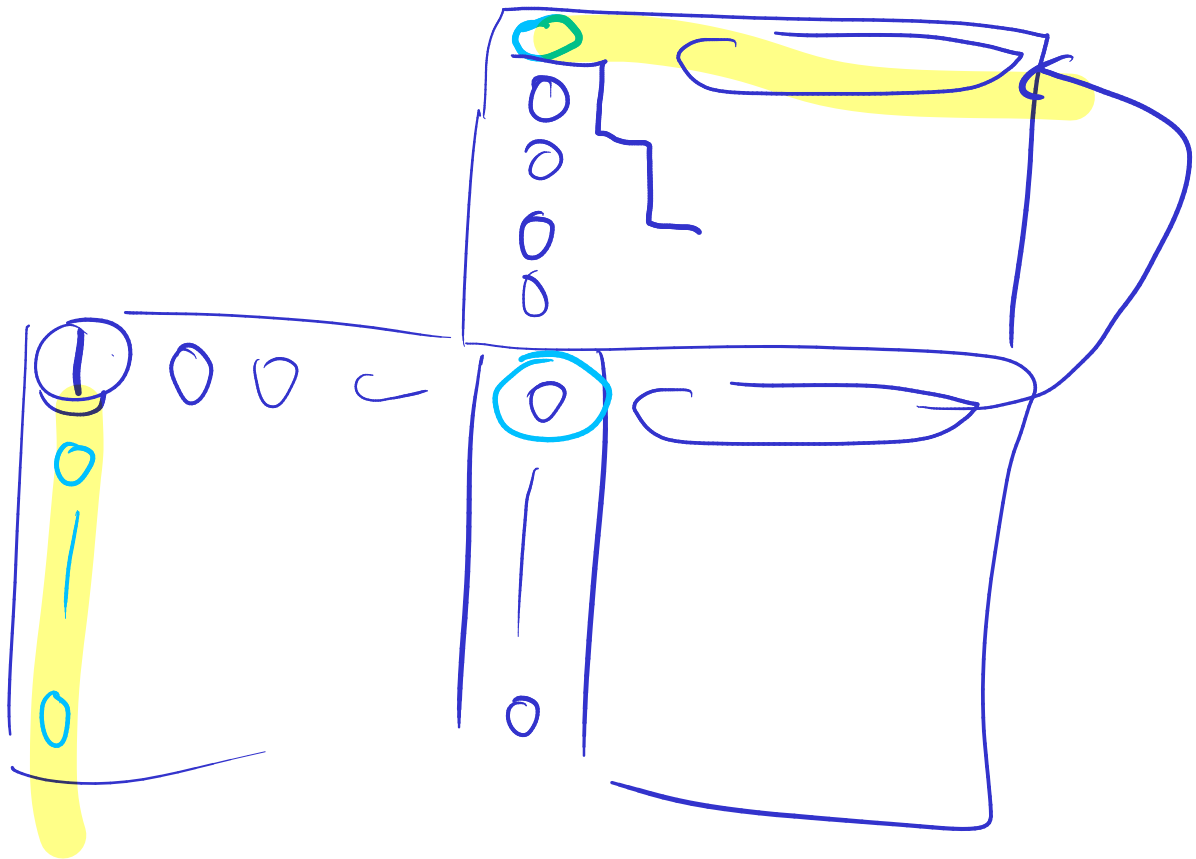
{ 1024 either special
  -1022 (1 special)

252 magnitude due to no

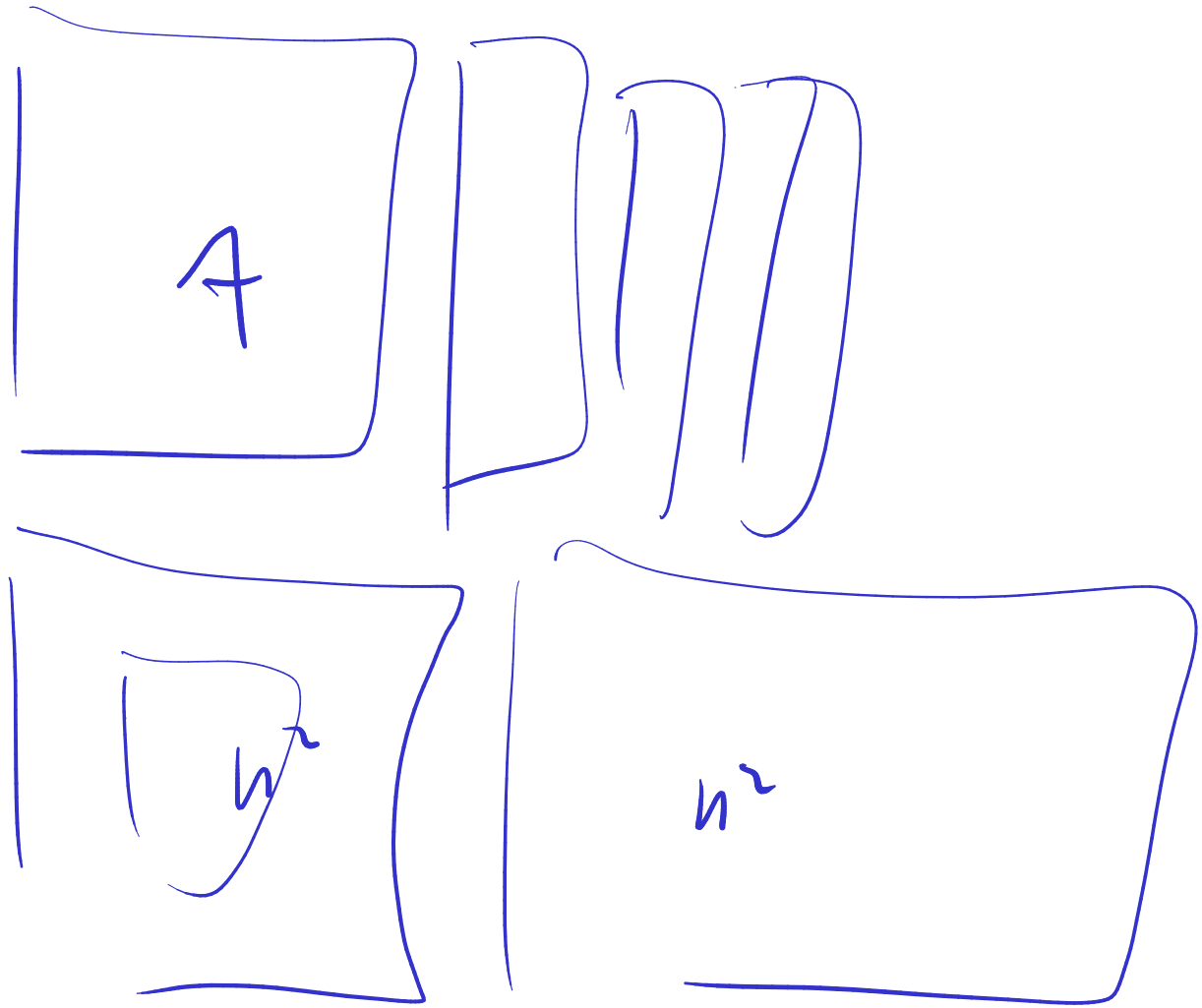
→ less than 1

Outline

What happens with zero columns in LU factorization?



Why is BLAS3 generically more efficient than BLAS2?



How can you use the Schur complement to lower the complexity of a solve?

↳ Woodbury.

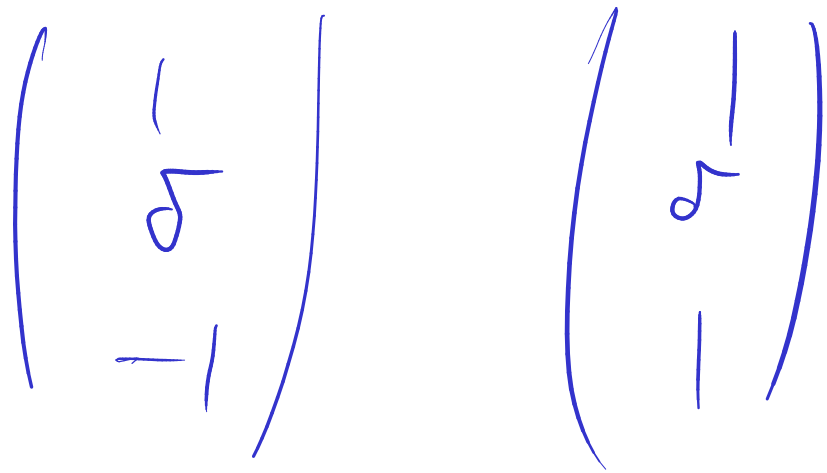
$$\left(\begin{array}{cc|c} A & B & b_1 \\ C & D & b_2 \end{array}\right)$$

$$\left(\begin{array}{cc|c} & & b_1 \\ & D - CA^{-1}B & \cdots \end{array}\right)$$

Outline

$A + uv^T$

Orthogonality can only be determined up to sqrt(eps_{mach}). Why?



$\delta < \sqrt{\varepsilon_{mach}}$

$\delta^2 < \varepsilon_{mach}$

$\underbrace{1 + \delta^2}_{\approx 1} - 1$

Orthogonal matrices have perfect conditioning. What's the mismatch?

Q

$\|Q\|_2 = 1$

$\|Q^T\| = 1$

$\kappa_2(Q) = 1$

$Q^T x =$ 

$\rightarrow$ rel. to

$\|Q^T x\| = \|x\|$

Provide a bound on the quality of QR factorization

$$Q_n \cdots Q_1 A = R$$

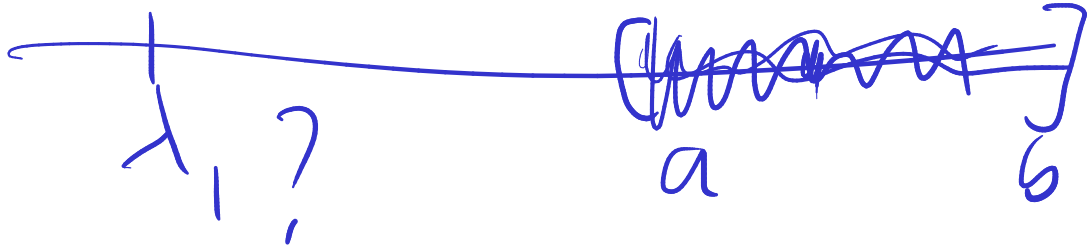
$k_2 = 1$ $\qquad$ $k = 1$

$$\|R - \hat{R}\|_2 \leq \|A - \hat{A}\|_2$$

Outline

In power iteration on a symmetric matrix, how might you 'kill off' eigenvalues in a whole interval?

- What is a "filter polynomial"?



$$A^5 - 5A^3 + A - I$$

What does a Krylov space buy you? Does it solve any specific problem?

- What's the setting for Krylov space methods?

Outline

What does it mean when the Jacobian you encounter in Newton's method is block-diagnoal?

- What is the approximant to the function used by Broyden?

Outline

- Does convex imply coercive?
- Does coercive imply convex?
- Does unimodal imply convex?

Outline

- What does a Lebesgue constant of 10,000 mean?

Outline

- How do you apply finite differences on an equispaced grid given a differentiation matrix on an equispaced grid?

- How do you compute a composite Gaussian integral?