# Lecture 30

Pacing
- Exam Monday 7:30-10:30pm
- Last Class
- Course Survey
- Office Hrs 9-10a Today on Zoom

Not the best random sampling algorithm!
- What method to use at what point?
- Can we use bounds + MCTS to ignore SVD?
- Reason to use randomized algs: efficiency. Many!

Real algs better than deterministic algs!

1. Use your software (LAPACK, numerical libraries)

$\leq 10k$ by $10k$: use \ (Classic Gauss, etc...)

$10k$ to $100k$: choose → LU. If many solves: \, Subspace? Space check rank

$\geq 10k$ by $10k$: maybe not \.

Sparse Matrix:
- Row NONZERO. Use sparsity.
- Use Sparsity Preserving Cholesky preordering!
- OK: Think about your pattern!
- OK: If symmetric: Use MINRES!

X vs b:
Use Eigs/LANCZOS or use power method if there's sufficiency for tangent Sketch.
- Or: use PCA/Rank etc.

Plug and play ideas!

Why Randomized Algs?
- Efficiency!
- Memory!
- Avoid worst case slow cases.

→ Why Matrix Sketches?
Real alg uses lots of Matrix Alt.

$$A_{ij} = \sum_k B_{ik} C_{kj} \quad \forall ij$$

QR

$$A = \int_0^1 C(x) \cos^2 dx \approx \sum_{i=1}^{N} C(X_i) \cos^2 \frac{1}{N}$$

where $X_i \sim \text{rand}(0)$.

Big Steps Random Walk Gen

$10^{80}$ — good power to RAND gen

$10^5$ — terrible! (rand(10^9) will repeat!)

Steps Steps Thru $N$ R.V. $10^{20}$