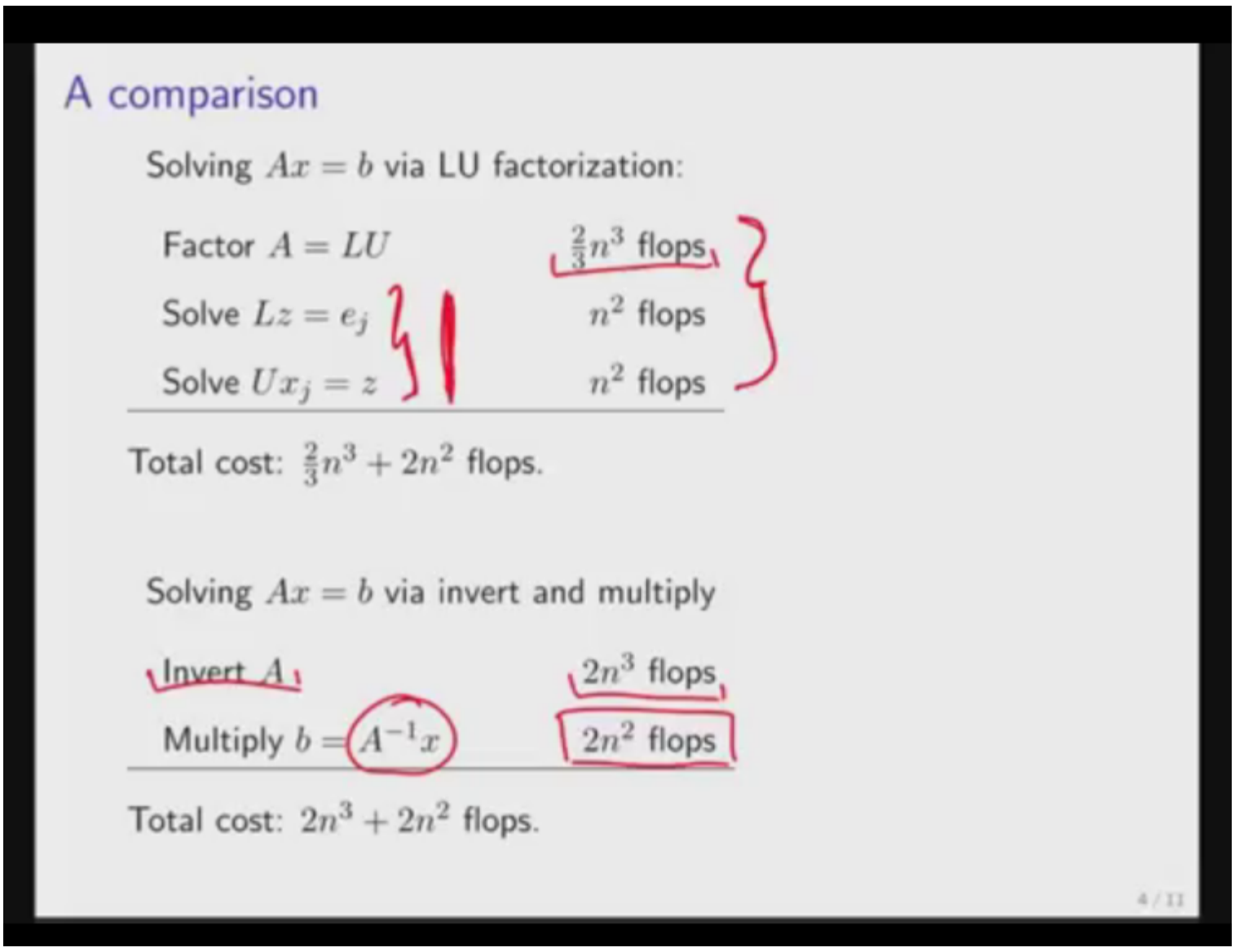
8.3.1 Solving Ax = b

Week 8 due Nov 26, 2023 15:12 IST

8.3.1 Solving Ax = b via LU Factorization

Around minute 1:30 there a few problems...



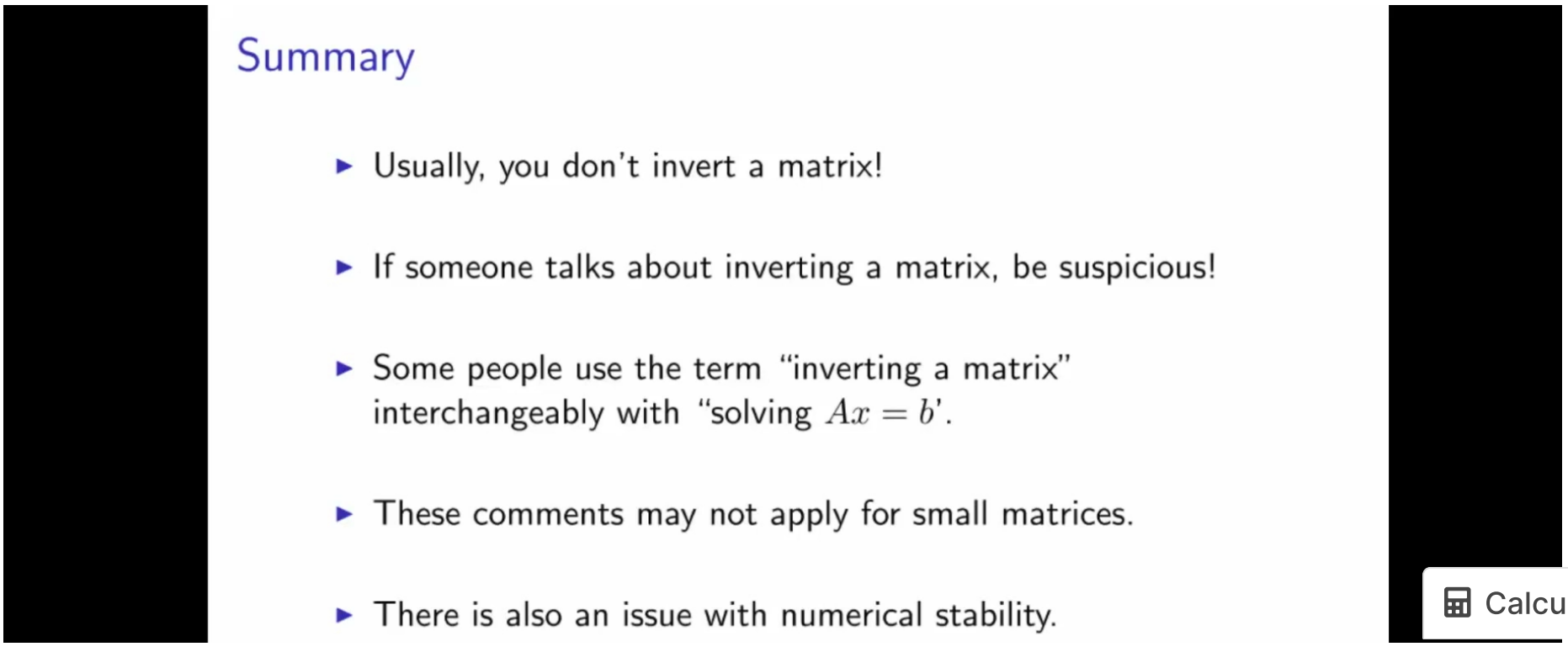
$Lz = e_j$ should be $Lz = b$.

$Ux_j = z$ should be $Ux = z$.

$b = A^{-1}x$ should be $x = A^{-1}b$.

(This video was made during a busy time last spring...)

Thanks to "bzeckel" for pointing this out.



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Reading Assignment

0 points possible (ungraded)
Read Unit 8.3.1 of the notes. [LINK]

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Answers are displayed within the problem

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Topic: Week 8 / 8.3.1

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? Question
Hi! I just took an algorithm course last semester, and the algorithm analysis here is a bit different from what I learned in the algorithm course. Fr... 2

? Inverting flops
Why does inverting matrix A cost 2n^3? flops? 2

Homework 8.3.1.1

1/1 point (graded)
Let $A \in \mathbb{R}^{n \times n}$ and $x, b \in \mathbb{R}^n$. What is the cost of solving $Ax = b$ via LU factorization (assuming there is nothing special about A)? You may ignore the need for pivoting.

- approximately $\frac{2}{3}n^4 + 2n^2$ flops
- approximately $2n^3 + 2n^2$ flops
- approximately $\frac{2}{3}n^3 + 2n^2$ flops

LU factorization requires approximately $\frac{2}{3}n^3$ flops and the two triangular solves require approximately n^2 flops each, for a total cost of

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$$\frac{2}{3}n^3 + 2n^2 \text{ flops.}$$

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Answers are displayed within the problem

Homework 8.3.1.2

1/1 point (graded)

Let $A \in \mathbb{R}^{n \times n}$ and $x, b \in \mathbb{R}^n$. What is the cost of solving $Ax = b$ if you first invert matrix A and than compute $x = A^{-1}b$? (Assume there is nothing special about A and ignore the need for pivoting.)

- approximately $\frac{2}{3}n^4 + 2n^2$ flops
- approximately $2n^3 + 2n^2$ flops
- approximately $\frac{2}{3}n^3$ flops

✔

Inverting the matrix requires approximately $2n^3$ flops and the matrix-vector multiplication approximately $2n^2$ flops, for a total cost of, approximately,

$$2n^3 + 2n^2 \text{ flops.}$$

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