Test 1

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January 9, 2025

- **Please submit a pdf with your answers on blackboard by Thursday 16th of January at 13:00. Please state name, surname and CID.**

  Use the handouts to reply to these questions. Do not use generative AI tools. Note that each answer is in the handouts (and the CVXPY ones on the cvxpy website)

  You cannot answer using screenshots. You need to reply by typing or in your own writing. This promotes subconscious retention.

  This is an individual test. You cannot collaborate with other students or any other individual. This must be your work.

  You should be able to complete this in 1 page. Do not write, nor spend too much time on this.

1. State all the languages you speak (this information will be used to inform group making).
2. Write the solution of

$$\min_x ||Ax - b||_2^2$$

3. Explain why in the norm approximation problem, the ℓ_1-norm generates a large number of zero residuals.
4. Which penalty function would you pick to reduce sensitivity to outliers?
5. Give the solution to the ℓ_2 least-norm problem

$$\begin{array}{ll} \min\limits_x & ||x||_2^2 \\ \text{s.t.} & Ax = b \end{array}$$

6. Give the solution of the Tikhonov regularisation problem.
7. Make a comparison between the solution of the nominal least-square, stochastic least-square and worst-case least-square.
8. Declare a variable x of dimension n in CVXPY.
9. Declare the constraints $x + y = 1$ and $x - y \geq 1$ in CVXPY.
10. Which atomic function would you use in CVXPY to compute the ℓ_∞-norm of a variable x?