Sublinear Time and Space Algorithms 2026A – Problem Set 3

Robert Krauthgamer

Due: December 17, 2025

General instructions: Please keep your answers short and easy to read. You can use results, calculations or notation seen in class without repeating them, unless asked explicitly to redo them.

1. Design a streaming algorithm that $(1+\epsilon)$-approximates the ℓ_0 norm (Distinct Elements) even with deletions.

   Hint: Use the ideas of the ℓ_0 sampler, and consider first the problem of distinguishing whether the ℓ_0 norm is at most k or more than $2k$. Then explain *briefly* how to extend this to $(1+\epsilon)$-approximation; skip small calculations, and write explicitly the overall storage bound.

2. Pick your favorite LLM, ask it one question from problem set 2, and evaluate its answer. Summarize it in one paragraph that discusses: (a) which LLM you used; (b) how well did it understand the question? (c) did it solve the question correctly? completely or only partially? does the solution contain flaws, gaps or unnecessary steps? (d) how well is it written? is it concise or verbose? well-explained?