

**Open Problem 3.2** *Given a symmetric matrix  $M$  with small condition number, is there a quasi-linear time (on  $n$  and the number of non-zero entries of  $M$ ) procedure that certifies that  $M \succeq 0$ . More specifically, the procedure can be randomized in the sense that it may, with some probability not certify that  $M \succeq 0$  even if that is the case, what is important is that it never produces erroneous certificates (and that it has a bounded-away-from-zero probability of succeeding, provided that  $M \succeq 0$ ).*

The Cholesky decomposition produces such certificates, but we do not know how to compute it in quasi-linear time. Note also that the power method can be used in  $\alpha I - M$  to produce certificates that have arbitrarily small probability of being false certificates. Later in these lecture we will discuss the practical relevance of such a method as a tool to quickly certify solution produced by heuristics [Ban15b].

## Tghgtgpeg

[Ban15b] A. S. Bandeira. A note on probably certifiably correct algorithms. *Available at arXiv:1509.00824 [math.OA]*, 2015.

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