Homework 2, Fall 2025 18338

Due 9/16 11:59pm

Please submit your homework via canvas.mit.edu.
If you are submitting .jl or .ipynb files, you must additionally submit .html or .pdf file
that captures running notebook or code.

Reading and Notes

Read chapters 7, 13, 14, 21 of the class notes (The lecture notes can be found in Piazza: http://piazza.com/mit/fall2025/18
Optional, but if you do this I'll get to know you : Provide feedback especially high level style and where
things did not make sense, in addition to spelling or technical errors.

Problem sets

1. Do at least four of the following problems.

   - Exercise 7.1 (page 124)
   - Exercise 7.2 (page 124)
   - Exercise 7.3 (page 126)
   - Exercise 7.4 (page 129)
   - Exercise 7.5 (page 130)
   - Exercise 7.6 (page 131)

2. See Lanczos tridiagonalization at page 254. Prove that the following sequence readily solves for the
   red variables in the Lanczos tridiagonalization algorithm:

$$\hat{w}_k = Dq_k, \alpha_k = \hat{w}_k^T q_k, w_k = \hat{w}_k - \alpha_k q_k - \beta_{k-1} q_{k-1}, \beta_k = ||w_k||, q_{k+1} = w_k/\beta_k$$

3. Do at least four of the following problems.

   - Exercise 13.1 (page 263)
   - Exercise 13.2 (page 264)
   - Exercise 13.3 (page 264)
   - Exercise 13.4 (page 265)
   - Exercise 13.5 (page 265)
   - Exercise 13.6 (page 265)