

Homework 8

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Due Tuesday by 11:59pm **Points** 100 **Submitting** a file upload
Available until Nov 23 at 11:59pm

Reading: Chap. 16 & 17

Written:

- A16.2
- A16.3
- A16.4 (Hint: read the QR factorization method for solving constrained least squares to get some inspiration.)
- Consider an unconstrained least squares problem to minimize $\|Ax - b\|^2$ over the variable $x \in \mathbb{R}^n$. The size of the matrix A is $m \times n$. Reformulate this problem as a constrained least squares problem, so that the solution can be obtained by the LDLT factorization of a $(m + n) \times (m + n)$ matrix. Hint: First define the residual vector $y = b - Ax$ and formulate the problem with variables (x, y) ; then write out the KKT equation and eliminate the Lagrangian multipliers. (The reason we might want to do this is because sometimes the matrix A is sparse; there exists methods that could take the LDLT factorization of a sparse matrix much more efficiently compared to directly taking the QR factorization of A or the Cholesky factorization of $A^T A$.)