Optimization for Machine Learning (Spring 2026): Homework 4

- LO4ML stands for the textbook *Linear Algebra and Optimization for Machine Learning*.
- You **must email your submission** as a **PDF file** to kbala@wsu.edu. You are welcome to write answers by hand and scan the pages. Put all the images on a PDF file, though.
- Your file name should identify you in the following manner. If you are Gregory Of Yardale, you should **name your submission GregoryYardale_Hw4.pdf**. If you want to add more bits to the title, e.g., Math565, you could name it GregoryYardale_Math565_Hw4.pdf, for instance. But you should **start the file name with GregoryYardale. And please avoid white spaces in the file name**.
- **Begin the SUBJECT of your email submission with the same `FirstnameLastname`, expression, e.g., "GregoryYardale Hw4 submission".**
- **This homework is due by 10:00 PM on Tuesday, April 7**.

1. (25) LO4ML Problem 2 from Page 251.

2. (15) LO4ML Problem 9 from Page 252.

3. (35) LO4ML Problem 12 from Page 252.

4. (25) We saw in class (see Lecture 16) that in the L-BFGS method, we initialize $G_0 = \gamma_0 I$ for $\gamma_0 = \dfrac{\mathbf{q}_0^T \mathbf{v}_0}{\mathbf{v}_0^T \mathbf{v}_0}$. Explain how this γ_0 value can be derived as the solution to an optimization problem that tries to "align" $\mathbf{q}_0$ and $\mathbf{v}_0$. Also give an explanation for why this scaling "aligns" the identity matrix I with the true Hessian.