Suggested Problems

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The below are some suggested problems to help retain the concepts in our deep learning text.

- On page 25 we see the following identity

$$\frac{||f(\rho(\tau)x) - f(x)||}{||x||} = \mathcal{O}(1)$$

  Prove this. In the above, $\tau(u) = u - \tilde{\tau}(u)$ for $sup_{u\in\Omega}||\tilde{\tau}(u)|| \leq \epsilon$ and $f = f_\xi : x \mapsto |\hat{x}(\xi)|$.

- On page 33, the book discusses permutation matrices $P = P_\sigma$ which are representations of the permutation group Σ_n on feature space of nodes in a graph. They indicate that applying P_σ to the feature matrix applies *conjugating* the adjacency matrix, viz. $A \mapsto P_\sigma A P_\sigma^T$. Prove this.

- On page 37, the authors mention that circular matrices commute. This follows from the fact that convolutions in general form a commutative algebra. Prove this fact. Namely, prove that convolution operations are commutative.

- Suppose that A is an invertible $n \times n$ matrix and let $\mathcal{F}$ denote the Fourier transform operator. Prove that $\mathcal{F}(\rho_{A^{-1}}f) = \frac{\rho_{A^T}\mathcal{F}(f)}{|\det A|}$.