Past Papers unofficial solutions

While studying and unable to have the solutions for these papers, I decided to create this document which will contain all (unofficial) solutions from every question from every past paper in the MLPR course. There are only a few days till the exam, so I won't be writing answers in details; rather a sentence or a phrase to which you can use to expand your solution for that question.

These answers have been written by me or with some assistance from someone who knew the topic or material more than I do. Some questions contain multiple possible answers. It's important to note that **these answers are not official and not fact checked with a course organizer**. Take them with a grant of salt.

If you have any suggestion or any edits I should make, please email me and I will immediately act on it.

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1. A) Solutions:
    i. Gaussian Elimination -> epoch form -> # of Non 0 rows Σ(2), so not full rank ∴ Σ(2) causes the problem.
    ii. Cholesky Decomposition – numpy.linlang.cholesky(Σ) -> Σ(2) throws an error.
2. A)
    i. L2 Regularization to the diagonal of the matrix – makes it positive definite
    ii. Use Partial Eigenvalue Decomposition on Σ(2) = QΛQ^T. replace negative eigenvalues with 0 -> reconstruct Σ(2).

    B)
    i. Function based on description (large values close to edges):
    sigmoid with range (3,5): $a_{t+1} = 3 + \sigma\left(\eta \cdot \nabla_a c(a_t)\right) \cdot 2$, with cost function $c(a) = \frac{1}{2m}\sum_{i=1}^{m}\left(y_i - f(x_i; a)\right)^2$ where the partial derivative is: $\frac{\partial c}{\partial a} = -\frac{1}{m}\sum_{i=1}^{m}\left(y_i - f(x_i; a)\right)\frac{\partial f(x_i;a)}{\partial a}$. Use a small learning rate, $\eta = 0.001$.
    ii. ☹
    iii. ☹
3. A)
    i. D features, N data points -> O(D*N)
    ii. Full Covariance -> O(N*D^2)

    B)
    i. Pro: Faster computationally.
    ii. Pro: Suitable for large databases, thanks to the use of mini batches.
    iii. Con: Harder to implement.

iv. Con: Higher Computational Complexity (greater Big “Oh”).