

Note: UG: 100, G: 100

Problem 1: (35/35) On Gradient Descent (GD). Find the global minimum of $f(t) = 50 * \sin(t) + t^2$ over $-10 \leq t \leq 10$. This problem intends to give you a hands-on experience on how gradient descent works and how it can get trapped at the local minimum.

- a) (5/5) Use MATLAB (or whatever toolbox) to plot this function. Visualize the multiple local minima and the global minimum.
- b) Use gradient descent to find the global minimum. (you can use the code provided in the lecture note)
 - i) (10/10) Pick a starting point at $t=7$. What's the minimum?
 - ii) (10/10) Pick a starting point at $t=1$. What's the minimum?
 - iii) (10/10) Change the step size and see what kind of step size will help overpass the local minimum when $t=7$.

Problem 2: (30/30) On Perceptron. Use Perceptron to implement the OR logic and the XOR logic. Show output from each iteration with the maximum number of iterations being 10. You can use either MATLAB or C/C++.

Problem 3: (35/35) Comparison between FLD, PCA, and Perceptron. Use the three methods to derive the projection directions for classifying the AND logic. You can use whichever language that you feel comfortable (pencil & paper, MATLAB, C/C++)