# Weight Initialization

## Assignment Questions

PW SKILLS

**Objective:** Assess understanding of weight initialization techniques in artificial neural networks. Evaluate the impact of different initialization methods on model performance. Enhance knowledge of weight initialization's role in improving convergence and avoiding vanishing/exploding gradients.

**Part 1: Understanding Weight Initialization**

1. Explain the importance of weight initialization in artificial neural networks. Why is it necessary to initialize the weights carefully?
2. Describe the challenges associated with improper weight initialization. How do these issues affect model training and convergence?
3. Discuss the concept of variance and how it relates to weight initialization. Why is it crucial to consider the variance of weights during initialization?

**Part 2: Weight Initialization Techniques**

4. Explain the concept of zero initialization. Discuss its potential limitations and when it can be appropriate to use.
5. Describe the process of random initialization. How can random initialization be adjusted to mitigate potential issues like saturation or vanishing/exploding gradients?
6. Discuss the concept of Xavier/Glorot initialization. Explain how it addresses the challenges of improper weight initialization and the underlying theory behind it.
7. Explain the concept of He initialization. How does it differ from Xavier initialization, and when is it preferred?

**Part 3: Applying Weight Initialization**

8. Implement different weight initialization techniques (zero initialization, random initialization, Xavier initialization, and He initialization) in a neural network using a framework of your choice. Train the model on a suitable dataset and compare the performance of the initialized models.
9. Discuss the considerations and tradeoffs when choosing the appropriate weight initialization technique for a given neural network architecture and task.

**Submission Guidelines:**

- **Answer all the questions in a single Jupyter Notebook file (.ipynb).**
- **Include necessary code, comments, and explanations to support your answers and implementation.**
- **Ensure the notebook runs without errors and is well-organized.**
- **Create a GitHub repository to host your assignment files.**
- **Rename the Jupyter Notebook file using the format "date_month_topic.ipynb" (e.g., "12_July_Weight_Initialization_Assignment.ipynb").**
- **Place the Jupyter Notebook file in the repository.**
- **Commit and push any additional files or resources required to run your code (if applicable) to the repository.**
- **Ensure the repository is publicly accessible.**
- **Submit the link to your GitHub repository as the assignment submission.**

**Grading Criteria:**

1. **Understanding and completeness of answers: 40%**
2. **Clarity and depth of explanations: 25%**
3. **Correct implementation of weight initialization techniques: 15%**
4. **Analysis and evaluation of initialization techniques: 10%**
5. **Proper code implementation and organization: 10%**

**Note:** *Create your assignment in Jupyter notebook and upload it to GitHub & share that uploaded assignment file link through your dashboard. Make sure the repository is public.*