CS 4033 Project 1

Your Name

1 Design Choices Made by the Assignment

The following choices were made by the assignment specification:

- **Learning paradigm:** Supervised learning, as labeled class data is provided.
- **Task type:** Binary classification — each sample belongs to one of two classes.
- **Architecture type:** Feedforward neural network with error backpropagation.
- **Loss signal:** Classification error between predicted and true class label.
- **Datasets:** Nine fixed datasets across Gaussian 2D, Gaussian 3D, and crescent moon distributions.

2 Design Choices Made by the Implementor

The following choices were made during implementation:

- **Hidden layers:** One hidden layer, as the universal approximation theorem guarantees a single hidden layer is sufficient to approximate any continuous function given enough neurons.
- **Hidden neurons:** 8 neurons per hidden layer.
- **Activation function:** Sigmoid, $\sigma(x) = \frac{1}{1+e^{-x}}$, chosen for its smooth gradient and natural probabilistic interpretation for binary classification.
- **Learning rate:** $\eta = 0.1$
- **Weight initialization:** Uniform random in $[-1, 1]$.