Assignment-1

Question 1: Generate all possible boolean functions for n inputs where $n \in \{1, 2, 3, 4\}$.

```
# Code summary:
# 1. Import necessary libraries.
# 2. Define a function to generate boolean functions for 'n' inputs
    .
# 3. Loop through the range of 'n' from 1 to 4.
# 4. Print the generated boolean functions and their total count.
```

Question 2: How many of these functions are learnable by an L-layer ANN for $L \in \{1, 2, 3, 4\}$?

```
# Code summary:
# 1. Generate all boolean functions for 'n' inputs.
# 2. Define functions for ReLU activation, forward and backward
    propagation.
# 3. Create a function to check if a boolean function is learnable
    by an L-layer ANN.
# 4. Count the number of learnable boolean functions for each value
     of 'n'.
# 5. Print the count of learnable functions for each L-layer.
```

Question 3: Implement the backpropagation algorithm for an L-layer ANN.

```
# Code summary:
# 1. Implement functions for forward propagation, backward
    propagation,
#    and weight updates.
# 2. Define a function to train the ANN with backpropagation.
# 3. Train the ANN using the generated boolean functions.
# 4. Test and validate the model.
```

Question 4: Train your ANN for classification of handwritten images of the MNIST dataset (0-9). Choose the number of layers and neurons accordingly.

```
# Code summary:
# 1. Load and preprocess the MNIST dataset.
# 2. Initialize the weights and biases for a 2-layer ANN.
# 3. Implement forward and backward propagation for the ANN.
# 4. Train the ANN on the MNIST dataset.
# 5. Predict and calculate the accuracy on the test set.
```

References

- Satish Kumar, *Neural networks: A classroom approach, 2nd edn*