Report Assignment 3 ML

1) *Find the trainign loss and accruacy, validation loss and accuracy and test loss and accuracy*

From the CNN training results, the recorded values were:

- **Training Accuracy:** 0.78
- **Training Loss:** 0.71
- **Validation Accuracy:** 0.81
- **Validation Loss:** 0.57
- **Test Accuracy:** 0.814
- **Test Loss:** 0.58

These results show that the model trained well and generalized effectively.
The validation and test accuracy are close to the training accuracy, which means the model did not overfit and performed consistently on unseen data.

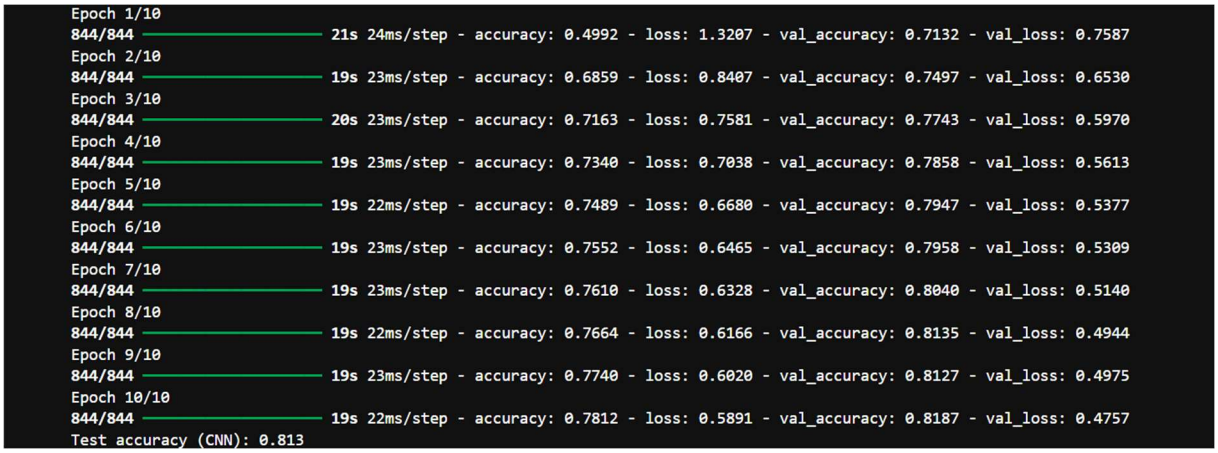
2) *Plot the confusion matrix:*

The confusion matrix shows how well the model classified each clothing item from the Fashion MNIST dataset.
Most predictions are correct (visible as darker blue diagonal values). The model performed very well on categories such as T-shirt/top**,** Trouser**,** Sneaker, and Bag**.**
However, it sometimes confused visually similar items like Shirt and Coat, or Sandal and Sneaker, which is normal since these items can look alike in grayscale images.

3) *Hyperparameters Used and why:*

I used two different models for this assignment: a simple dense neural network and a CNN model.

For the CNN model, I used two convolution layers followed by max pooling layers, one dense layer, and an output layer.
The first convolution layer had 32 filters, and the second had 64 filters, both using a 3×3 kernel to detect small image patterns.
Each convolution layer was followed by 2×2 max pooling to reduce the image size and prevent overfitting.
After flattening the output, I added a dense layer with 128 neurons and a dropout layer of 0.5 to reduce overfitting.
The ReLU activation function was used in hidden layers, and Softmax was used in the output layer to get class probabilities.
The model was trained using the Adam optimizer, categorical crossentropy loss, a batch size of 64, and 10 epochs.
These settings allowed the model to learn efficiently and reach a stable accuracy of around 81%.



Collaboration and contribution:

This assignment was completed individually.
No group collaboration was involved.

The work was divided into the following steps:

- Researching the Fashion MNIST dataset — understanding what it contains and where it comes from.
- Downloading the dataset using TensorFlow and displaying a sample image to confirm it loaded correctly.
- Building and training the neural network using a CNN model.
- Visualizing and analyzing the results using plots and the confusion matrix.