MachineLearning Final:

Q2A:

CNN (Convolutional Neural Network):
CNNs tend to be very good in capturing spatial hierarchies in images. In my implmentation of CNNs it consists of convolutional layers followed by max-pooling layers and dense layers. The convulutional layers extract certain features from the images through filters.

DNN (Deep Neural Networks):
DNNs consist of connected layers and are effective when learning patterns that are complex in data. In my implementation it is a simple feed forward network with multiple hidden layers. Each layer connects with another layer, this allows it to learn relations that are non-linear.

MLP (Multi-Layer perceptron):
They are feedforward networks with multiple layers of nodes, they can be used for both classification and regression. In my impelmentation it has multiple hidden layers with ReLU activation functions and a softmax output layer for classification.

Q2B:

In the project I used three diverse deep-learning models which are CNN, DNN and MLP. I then used an ensemble approach and this is how I did it.

First I individually trained each model on the fashion MNIST dataset, while training each model uses the input data and extracts distinct features and patterns based on the parameters of the model

Then we evaluate each model, from where we import sklearn.metrics to get the metrics we desire, in this case being accuracy, precision, recall and F1-score. These scores tell us the strength of the models along with their weaknesses

Generating predictions is also a key component to getting an ensemble prediction. We can use this to predict the class probabilities for each image in the dataset.

Now come the key parts to achieve the ensemble calculations, the prediction models we used are all combines and averages to form an ensemble prediction.

Which is what we did. This helps us in order to ensure there are no bias or errors.

By combining all the predictions from the three models, we improve the overall performance to any single model. This provides us with insight on how well the ensemble performs compared to the individual ones

Q2C:

`Final Metrics of Individual Models:`

Model	Accuracy	Precision	Recall	F1-Score
CNN	0.9905	0.906548	0.904	0.90468
DNN	0.8778	0.877663	0.8778	0.875762
MLP	0.8749	0.876199	0.8749	0.875076

`Final Metrics of the Committee:`

Model	Accuracy	Precision	Recall	F1-Score
Ensemble	0.9045	0.904322	0.9045	0.904302