**Module 21 HW: Neural Network Analysis**

The purpose of this analysis is to test the effectiveness of the neural network I created and to see if any optimizations made can make it more accurate. This analysis will look at the original neural network that was created and the 3 optimizations made to increase accuracy.

**Original Neural Network:**

In this original neural network columns EIN and NAME removed as they had high variability and could slow down the neural network due to a high range of values. The APPLACATION\_TYPE and CLASSIFICATION columns were binned to lower the number of inputs and increase the accuracy of the neural network. The preprocessed data was split into training and test sets to train the neural network and set to random state 78. The neural network contained two hidden layers which both had 6 nodes, and both had Rectified Linear Unit activation functions. The Output layer consisted of a sigmoid function. Upon running through 100 epochs the model had a test accuracy of 72.6%.

**First Optimization**:

The first optimized neural network contained all the same preprocessed as before except it also removed the AFFILIATION and ORGANIZATION columns from the data. The hidden layer nodes were all cut in half to only contain 3 nodes each. This lowered the accuracy of the model to 63.1% and therefore, this optimization should not be used due to the decreased efficiency.

**Second Optimization**

The second optimized neural network removed the SPECIAL\_CONSIDERATIONS column alongside the EIN and NAME columns. This optimization also added a third hidden layer that consisted of a sigmoidal activation function. Each hidden layer had a node count of 4, 3 and 2 respectively and the random state of the training model was set to 45. This optimization produced an accuracy of 72.4% which is slightly lower than the original model and therefore once again it should not be used.

**Third Optimization**

The third optimization added binning to the ASK\_AMT column that kept the columns with integers of 5000, 15583, 6725, 63981 and 10478 and binned the rest of the others. The two hidden layers had their node counts changed to 8 and 7. Upon testing this model produced an accuracy of 72.3% which just like optimization 2 had a slightly lower accuracy.

Overall, the best model put forward was the original network. I could not find an effective optimization for the data.