1. *AUTO ENCODER:* This problem will consider the training of a simple autoencoder on a sample from the MINST. Specifically, consider the data set used in Homework 3 (0's and 9's) `minst0_train.dat` and `minst9_train.dat` (note, not the binary versions, although you are welcome to use the binary versions from HW 4 in addition and compare them).

   (a) Fit a basic autoencoder assuming a sigmoidal function from input to hidden layer and linear function from hidden to output layer. Use backpropagation. Explore your model for various numbers of hidden units and look at image plots of the weight matrices. Describe your results and show a couple of examples.

   (b) Add an L_2 regularization penalty for the weights. Repeat the analysis in the first part and report your results and comparixon for different values of the regularization penalty (λ).

   (c) Try to include the KL sparseness penalty if you can. Explore the value of different values of β and report your results.

   (d) Describe any implementation issues or interesting findings from your implementation. (Include a copy of your R code for your final version of the autoencoder).