Name: _____

Sources of error

2. (10 points) Recall that *structural* error arises when the hypothesis class cannot represent a hypothesis that performs well on the test data and *estimation* error arises when the parameters of a hypotheses cannot be estimated well based on the training data.

   Following is a collection of potential cures for a situation in which your learning algorithm generates a hypothesis with high test error.

   For each one, indicate whether it **can reduce** structural error, estimation error, neither, or both.

   (a) Penalize $\|\theta\|^2$ during training
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (b) Penalize $\|\theta\|^2$ during testing
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (c) Increase the amount of training data
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (d) Increase the order of a fixed polynomial basis
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (e) Decrease the order of a fixed polynomial basis
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (f) Add more layers with linear activation functions to your neural network
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (g) Add more layers with non-linear activation functions to your neural network
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (h) Stop training before training error reaches 0
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   For each of the following situations, indicate whether the **poor performance is due to** high structural error, high estimation error, neither, or both.

   (i) Neural network has very low training error but high testing error.
   ◯ structural error ◯ estimation error ◯ both ◯ neither

   (j) Neural network training error is persistently high, as is test error.
   ◯ structural error ◯ estimation error ◯ both ◯ neither