

Name: \_\_\_\_\_

*This quiz totals 20 points. The quiz is open-note, but not open-neighbor. Relax and try to do the best you can.*

1. (5 points) What is machine learning? How does it work? Give some examples of machine learning in the world today.

**Solution:** Machine learning is the idea that we can get computers to “learn” for themselves without being explicitly programmed. The computer is “trained” according to some task and comes up with a function on its own that predicts well out of sample. It then uses this function to pass its knowledge on to other contexts of the same task.

Popular examples of machine learning in the world today include voice assistants, Optical Character Recognition (OCR) systems, and gaming bots.

2. (5 points) What is the difference between L1 and L2 regularization?

**Solution:** L1 regularization penalizes the objective (“cost”) function by  $\lambda \sum_k |\beta_k|$ . L2 regularization penalizes by  $\lambda \sum_k \beta_k^2$ .

3. (5 points) What is the tradeoff that regularization attempts to solve? How is this related to overfitting?

**Solution:** Regularization attempts to solve the bias-variance tradeoff. That is, an algorithm that is not flexible or complex enough will do a poor job of predicting both in-sample and out-of-sample. We say that this algorithm has high bias or that this algorithm underfits.

An algorithm that is too flexible or complex will do a great job of predicting in-sample but a poor job of predicting out-of-sample. We say that this algorithm has high variance or that this algorithm overfits.

4. (5 points) Machine learning is all about finding the best \_\_\_\_, and econometrics is all about finding the best \_\_\_\_.
- a.  $\hat{y}; \hat{y}$
  - b.  $\hat{\beta}; \hat{y}$
  - c.  $\hat{y}; \hat{\beta}$
  - d.  $\hat{\beta}; \hat{\beta}$

**Solution:** The answer is (c). This is straight from the lecture notes.