CPS 5310 Spring 2015
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Midterm Review Guide

For the midterm exam, you should be able to do the following:

1. Describe how to set up hypothesis tests for one sample and two sample datasets. Interpret the results of such a test.

2. Describe how to perform simple and multiple linear regression. Interpret the results of such a regression model. Evaluate the goodness of fit of a regression model. Use a regression model to do prediction. Describe how to use cross validation to evaluate the goodness of prediction. Interpret the results of a cross validation.

3. Distinguish between linear and nonlinear regression and determine which method is appropriate for a given problem. Explain how a neural network can be used to do nonlinear regression modeling.

4. Classify ordinary differential equations (ODEs) according to order and linear vs. nonlinear. Write a second order ODE as a system of two first order ODEs.

5. Formulate an ODE model given a problem description for problems such as Newton's Law of Cooling, population growth, and predator-prey systems. Find and interpret equilibrium solutions of the model. Describe the expected behavior of the solutions.

6. Compare and contrast forward differentiation and backwards differentiation numerical methods for solving ODEs. Work through a few steps of a numerical solution using a simple numerical method. Describe types of errors incurred in numerical solution of ODEs and relate error to the order of the numerical method.

7. Explain what is meant by a bifurcation point of an ODE model and give an example. Interpret the results of varying the parameters of a problem that has a bifurcation point.

8. Take-home problem: Given a description of an ODE problem and sample data that have been collected, formulate a model using ODEs, solve the model and fit it to the data using software of your choice, and display the results graphically.