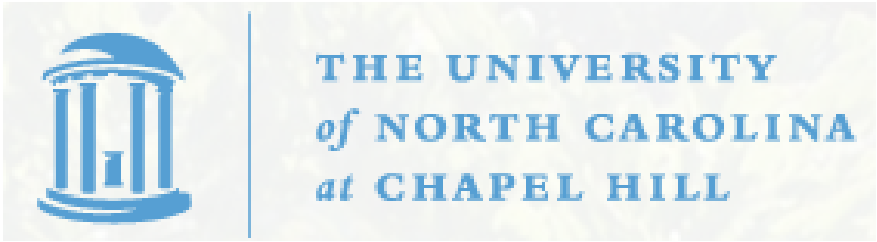
# *STOR 590:*
# *ADVANCED LINEAR MODELS*
# *Instructor: Richard L. Smith*

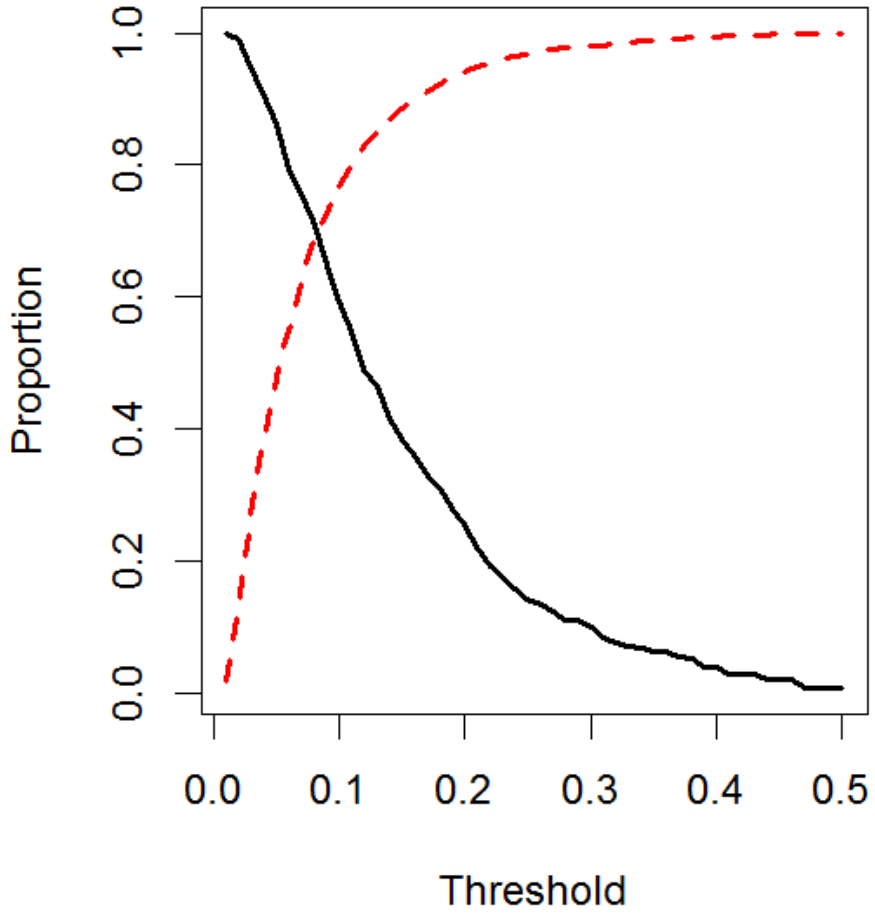
## Class Notes:

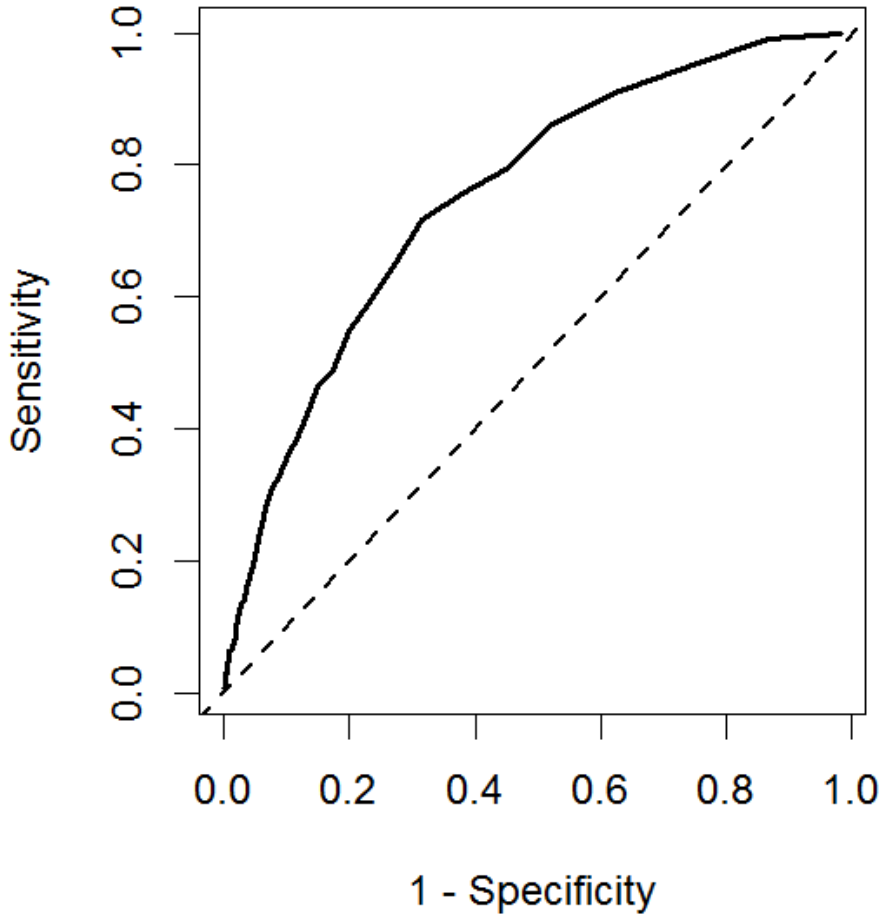
## September 2, 2020



# Sensitivity and Specificity

- Assume we are testing for a disease or some specific health outcome, and we use a diagnostic test to predict the outcome
- Specificity: the probability that a person who *does not have* the disease is correctly predicted to not have the disease
- Sensitivity: the probability that a person who *does have* the disease is correctly predicted to have the disease
- After subtracting from 1, these are analogous to type I error and type II error, respectively
- Sensitivity is also the *power of the test*
- As the threshold for detection rises, the specificity increases but the sensitivity decreases
- The plot of Sensitivity against 1-Specificity is called the *Receiver Operating Characteristic* or ROC curve


Proportion
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.1
0.2
0.3
0.4
0.5
Threshold


Sensitivity
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
1 - Specificity

# Naglekerke's Statistic (Text, p. 43)

$$R^2 = \frac{1 - (\hat{L}_0/\hat{L})^{2/n}}{1 - \hat{L}_0^{2/n}} \text{ where}$$

- $\hat{L}_0$: Maximized log likelihood under the null hypothesis (all regression coefficients zero except the intercept)
- $\hat{L}$: Maximized log likelihood under the alternative hypothesis
- $n$: sample size
- $0 \leq R^2 \leq 1$
- An alternative to the linear model $R^2$ that is appropriate for generalized linear models
- Interpretation same as traditional $R^2$; the larger the better, but there is no absolute criterion for what is good. In this example, the best model has $R^2 = 0.143$.