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

Class Notes:

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THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

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CLASS ANNOUNCEMENTS

- New grading policy — P/F grades allowed, but see registrar's web page for details
- If you drop the course after today, you will get a "WCV" grade
- **Next assignment: Chapter 2, questions 2 and 4, due 11:55 pm Friday, September 11**
- Still plan September 28 date for midterm, will firm this up after Labor Day
- I may decide after all to hold a class on October 12, but will confirm later
- After Chapter 2, we will jump to Chapter 8. See "GLM" handout in Resources/Handouts section of sakai page

Deviance Residuals

- Define the *deviance* as

$$
\begin{aligned}
D &= 2\ell(\widehat{\theta}) \\
&= 2\sum_i \left[\log\{1+\exp(\widehat{\beta}_0+\widehat{\beta}_1 x_i)\} - y_i(\widehat{\beta}_0+\widehat{\beta}_1 x_i)\right] \\
&= \sum_i r_i^2
\end{aligned}
$$

where

$$
r_i^2 = 2\left[\log\{1+\exp(\widehat{\beta}_0+\widehat{\beta}_1 x_i)\} - y_i(\widehat{\beta}_0+\widehat{\beta}_1 x_i)\right]
$$

Ensure correct sign by defining

$$
r_i = \text{sign}(y_i - \widehat{p}_i)\sqrt{r_i^2}.
$$

We call r_i the i'th *deviance residual* (text, page 36).

In R: `residuals(lmod)`

Side Comment

- We defined

$$r_i^2 \;=\; 2\left[\log\{1+\exp(\widehat{\beta}_0+\widehat{\beta}_1 x_i)\} - y_i(\widehat{\beta}_0+\widehat{\beta}_1 x_i)\right]$$

  Do we know this is > 0?

- Claim: $\log(1+e^z) - yz > 0$ when $-\infty < z < \infty,\;\; y = 0$ or 1

- $y = 0:\;\; \log(1+e^z) > \log(1) > 0$

- $y = 1:\;\; \log(1+e^z) - z > \log(e^z) - z = 0$

- So OK either way.