Lecture 08
Measuring Airline On-time Performance

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Notes

- Problem Set #2 - Due next class
- Problem Set #3 - Due the following Wednesday
- Midtern I - Two weeks from today

Goals for today

- Review of time
- Simulation of the multivariate F-test
- Introduction to ASA airline dataset

Review from Last Time

We did a lot of matrix manipulations in the proofs of these two results. The most important 'big picture' results to remember are:

- If B is a symmetric idempotent matrix and $u \sim \mathcal{N}(0, \mathbb{I}_n)$, then $u^t B u \sim \chi^2_{\mathrm{tr(B)}}$.
- If B is a symmetric idempotent matrix, then all of B's eigenvalues are 0 or 1. In terms of the $Q^t \Lambda Q$ eigen-value decomposition, this helps explain why we think of P and M as projection matricies.

The Hypothesis test $H_0 : \beta_j = b_j$ yields the following **T-test**:

$$
\begin{aligned}
t &= \frac{\widehat{\beta}_j - b_j}{\sqrt{s^2 \left((X^t X)^{-1}_{jj} \right)}} \\
&= \frac{\widehat{\beta}_j - b_j}{\text{S.E.}(\widehat{\beta}_j)} \\
&\sim t_{n-p}
\end{aligned}
$$

The Hypothesis test $H_0 : D\beta = d$ for a full rank k by p matrix D yields the following **F-test**:

$$F = \frac{(\mathrm{SSR}_R - \mathrm{SSR}_U)/k}{\mathrm{SSR}_U/(n-p)}$$

Where we let SSR_U be the sum of squared residuals of the unrestricted model ($r^t r$) and SSR_R be the sum of squared residuals of the restricted model (where the sum of squares is minimzed subject to $D\beta = d$).

F-Test confidence region

ASA Flight Data