STATS 100C Midterm Exam 1 Information (Spring 2009)

- **Midterm exam 1: Monday, April 20, 2-2:50pm in MS 8125.**
- This is a closed-book exam, but you can use a calculator and the formulas provided.
- The z, t and F tables will be provided if necessary.
- Material: Chapters 1-3, HW 1-3.

The following formulas will be provided.

Chapter 2: Simple Linear Regression

The pdf of $N(\mu, \sigma^2)$ is $f(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp[-\frac{(x-\mu)^2}{2\sigma^2}]$.
Model: $y_i = \beta_0 + \beta_1 x_i + \epsilon_i$. LSE: $\hat{\beta}_1 = \frac{s_{xy}}{s_{xx}}$, $\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$, $\hat{\mu}_0 = \hat{\beta}_0 + \hat{\beta}_1 x_0$.
Variance: $V(\hat{\beta}_1) = \sigma^2 / s_{xx}$, $V(\hat{\beta}_0) = \sigma^2(\frac{1}{n} + \frac{\bar{x}^2}{s_{xx}})$, $V(\hat{\mu}_0) = \sigma^2(\frac{1}{n} + \frac{(x_0-\bar{x})^2}{s_{xx}})$.
Notation: $r = s_{xy}/\sqrt{s_{xx}s_{yy}}$, $s_{xx} = \sum(x_i - \bar{x})^2 = \sum x_i^2 - \frac{1}{n}(\sum x_i)^2$
$s_{xy} = \sum(x_i - \bar{x})(y_i - \bar{y}) = \sum(x_i - \bar{x})y_i = \sum x_i y_i - \frac{1}{n}(\sum x_i)(\sum y_i)$
$SST = \sum(y_i - \bar{y})^2$, $SSR = \sum(\hat{\mu}_i - \bar{y})^2 = \hat{\beta}_1^2 s_{xx}$ and $SSE = \sum(y_i - \hat{\mu}_i)^2$.

Chapter 3: Random Vectors Suppose $E(y) = \mu$ and $V(y) = \Sigma$.

$$E(Ay + b) = A\mu + b, V(Ay + b) = A\Sigma A', V(y) = E[(y - \mu)(y - \mu)'], cov(a'y, b'y) = a'\Sigma b.$$

The pdf of a n-variate normal distribution $N(\mu, \Sigma)$ is

$$f(x) = (2\pi)^{-\frac{n}{2}} |\Sigma|^{-\frac{1}{2}} \exp[-\frac{1}{2}(x - \mu)'\Sigma^{-1}(x - \mu)]$$