WHAT YOU SHOULD KNOW FOR THE 2011 MID-TERM EXAM

You are expected to know the following formulae and results for the 2011 mid-term exam.

1. The material in the “What is Statistics?” handout given out in the first day of class.

2. The “What you should know” material handed out given out in the first day of class, except the material at the end concerning the $t$ and $F$ distributions.

3. The definition of the gamma function, the relation $\Gamma(x) = (x-1)\Gamma(x-1)$, the fact that $\Gamma(1) = 1$, (so that $\Gamma(n) = (n-1)!$ if $n$ is an integer), and the fact that $\Gamma(1/2) = \sqrt{\pi}$.

4. The basic aims of Statistics as they relate to this course (in particular the estimation of parameters). The concept of an unbiased estimator of a parameter or of some function of a parameter, the variance and mean square error of an estimator and the relation between the variance and mean square error of an estimator.

5. The formula for the density function of the $i^{th}$ order statistic of $n$ iid continuous random variables. (Note: You do not have to know anything about properties of order statistics for discrete random variables.) The formula for the joint density function of the $i^{th}$ and the $j^{th}$ order statistics of $n$ iid continuous random variables.

6. The general ideas involved with the attempted approach to finding the “best” (i.e. minimum variance unbiased) estimator of a parameter via the Cramér-Rao bound, and the deficiencies of this approach. The formula for the Cramér-Rao bound for the variance of an unbiased estimator of $\theta$ and more generally of any function $\tau(\theta)$ in the case of $n$ iid random variables.

7. Equations [24], [25] and [26] and all the theory and results surrounding these equations.

8. The idea of a sufficient statistic for a parameter and more specifically the idea of a minimal non-trivial sufficient statistic (MNTSS). The factorization, “Smith/Jones” and exponential family approaches to finding a MNTSS in the case where the support of the random variables does not depend on the parameter of
interest.

9. The details of the case where the support of the random variables is of the form \((a, b(\theta))\), (that is that the only candidate for a MNTSS is \(Y_{(n)}\) and the factorization requirement that \(Y_{(n)}\) actually be a MNTSS).

10. The Rao-Blackwell theorem and the two approaches that it implies for finding the "best" estimator of a parameter.

11. The method of maximum likelihood estimation (one parameter case only) and the important properties of maximum likelihood estimators.