Homework problems will be assigned bi-weekly. will be graded. Please hand the problems to me before the class begins. You may discuss these problems with other students, but you must independently write up and submit your own solutions. Copying any part of a solution from a book, solutions guide, or website is cheating! Students are expected to abide by the Georgia Tech Academic Honor Code. Late homeworks will not be excepted, but you may drop your two lowest homework grades. Emailed homeworks will only be accepted with prior agreement of the Instructor - else they will not be accepted.

In order to grade as many problems as possible, your submitted problem sets should be printed very neatly and stapled. Please do not cross out. Write on only one side of each page and do not use paper that has been torn out of spiral bound notebooks. You may typeset your solutions, but I do not consider this a good use of your time. Edit your solutions carefully. Please do not show arithmetic and most algebra calculations. Your solutions should look like the solutions of examples in the text. Please either print or submit a screen shot of your code and solution of computer problems. Finally, if a problem can be solved without the use of a computer, then no partial credit will be awarded for a computer solution. Please submit all ODD numbered textbook problems, all computer simulation problems, as well as all non-text problems.

1. 7.4.7 (please submit)
2. 8.6: 7
3. Use the data set of durations between eruption of Old Faithful and estimate the mean duration time, and construct bootstrap confidence intervals three ways. Compare them.
4. 9.14: 2, 3, 4, 5, 7
5. Suppose $X_1, \cdots, X_n$ are IID random variables with pdf
   \[ f(x, \sigma) = \frac{1}{2\sigma} \exp\left(-\frac{|x|}{\sigma}\right). \]
   Find the Method of Moments and Method of Maximal Likelihood estimators for $\sigma$.
6. A sample of 3 observations, $(X_1 = 0.4, X_2 = 0.7, X_3 = 0.9)$ is collected from a continuous distribution with density
   \[ f(x, \theta) = \theta x^{\theta-1} \text{ for } 0 < x < 1. \]
   Find the Method of Moments and Method of Maximal Likelihood estimators for $\theta$.
7. In an equilibrium population, a certain gene has two alleles
   \begin{align*}
   &\left\{ \begin{array}{l}
   A \text{ with prob } \theta \\
   a \text{ with prob } 1 - \theta.
   \end{array} \right.
   \end{align*}
   Three genotypes exist with proportions given by the Hardy-Weinberg formula
   \begin{align*}
   &\left\{ \begin{array}{l}
   AA \text{ with prob } p_1 = \theta^2 \\
   Aa \text{ with prob } p_2 = 2\theta(1 - \theta) \\
   aa \text{ with prob } p_3 = (1 - \theta)^2.
   \end{array} \right.
   \end{align*}
   Suppose that a random sample yields $n_1$ individuals have genotype $AA$, $n_2$ individuals have genotype $Aa$ and $n_3$ individuals have genotype $aa$. Estimate $\theta$. 

8. Suppose that \( E[\hat{\theta}_1] = E[\hat{\theta}_2] = \theta, V[\hat{\theta}_1] = \sigma^2_1 \) and \( V[\hat{\theta}_2] = \sigma^2_2 \). Consider the estimator \( \hat{\theta}_3 = a\hat{\theta}_1 + (1-a)\hat{\theta}_2 \), where \( 0 \leq a \leq 1 \).

(a) Show that \( \hat{\theta}_3 \) is an unbiased estimator for \( \theta \).

(b) If \( \hat{\theta}_1 \) and \( \hat{\theta}_2 \) are independent, how should the constant \( a \) be chosen in order to minimize the variance of \( \hat{\theta}_3 \)?

(c) How should the constant \( a \) be chosen in order to minimize the variance of \( \hat{\theta}_3 \) if \( \hat{\theta}_1 \) and \( \hat{\theta}_2 \) are not independent but have covariance equal to \( c \neq 0 \)?

9. A health insurance company is investigating the cost of cancer patients within its plan, whose costs at the rate of 1,240 per month. A sample of 35 cases for November (the first 35 for which complete records were available) and an average cost of 1,100, with a standard deviation of 220. Is there any evidence of a significant change?

10. (Old) A old Time Magazine/CNN poll of 500 teens (16 and 17 year olds) found that 55% of the respondents said that they had sexual intercourse. Of this group, 61% said that they used birth control every time. Let \( p \) represent the true proportion of all 16 and 17 year olds who had sex and used birth control every time. A prominent televangelist claimed that morals in the U. S. are deteriorating rapidly with the proof being that "More than 30% of all 16 and 17 year olds are having sex and using birth control every time while doing it!". Did the data support this claim?

11. In a survival time study, \( n \) cancer patients were observed for a fixed time \( T \) after an operation and if the symptoms reappear, the time \( X \), since the operation, this happens is recorded. For \( r \) of these patients symptoms reappeared at times \( x_1, x_2, \ldots, x_r \) after their operation and the remaining \( n - r \) patients were still free of symptoms at the end of the time period \( T \). If the time \( X \) to the return of symptoms has exponential distribution \( f(x, \theta) = \theta e^{-\theta x} \) for \( x > 0 \), find the MLE estimator of \( \theta \) on the basis of the study results.

12. Let \( X_1, X_2, \ldots, X_n \) be a random from \( U[\theta - 1/2, \theta + 1/2] \). Find the MLE estimator for \( \theta \).