CS321: Numerical Methods in Comp Mol Bio

Homework 6

Due: Thursday, Oct 13 2005 at the begining of the section

Problem 1

Assume you are sampling values from a some unknown distribution with finite μ and σ (say a survey asking students to grade their TA on a 0-100 scale).
After getting the first 10 responses (10 samples) you got a mean of $\overline{X}_{10} = 61$.
Give a 95% confidence interval for μ.
After receiving all 50 responses from the students you got a mean of $\overline{X}_{50} = 53$.
Give a 95% confidence interval for μ.
Why would you use 2 different distributions for the two problems?

Problem 2

You have seen in class the maximum likelihhod estimator $\hat{A} = max(x_i)$ for the parameter A of a Uniform distribution on the interval (0,A).

Find a maximum likelihhod estimator for the parameters A and B of a Uniform distribution on the interval (A,B)?
Find a maximum likelihhod estimator for the parameter A of a Uniform distribution on the interval (-A,A).
Find a maximum likelihhod estimator for the parameter A of a Uniform distribution on the interval (A,2A).

Problem 3

Estimator $\hat{\Theta}$ is called an unbiased estimator for Θ if $E(\hat{\Theta}) = \Theta$ (notice that $\hat{\Theta}$ is indeed a random variable!).

Consider a Uniform distribution on the interval (0,A).
Is the maximum likelihood estimator for A unbiased?
Is $\hat{A}_1 = 2\overline{X}_n$ an estimator for A? Is it a reasonable estimator for A?
Is the above defined $\hat{A}_1$ an unbiased estimator for A?
Is $\hat{A}_2 = 2$ an estimator for A? Is it a reasonable estimator for A?
Is the above defined $\hat{A}_2$ an unbiased estimator for A?

Problem 4

Estimator $\hat{\Theta}_1$ is considered a tighter estimator for Θ than the estimator $\hat{\Theta}_2$ if for any value of Θ and any sequence of samples $x_1, x_2, ..., x_n$ $|\hat{\Theta}_1 - \Theta| < |\hat{\Theta}_2 - \Theta|$.

Once again consider a Uniform distribution on the interval (0,A).
Is the maximum likelihood estimator for A tighter than the above defined $\hat{A}_1$?
Is the maximum likelihood estimator for A tighter than the above defined $\hat{A}_2$?
Can you find an estimator for A that is tighter than $\hat{A}_1$?