

Rules: All quizzes and practice quizzes are open book and notes. If you can't answer the question you can give partial answers or change it to get some credit. You can guess at the answer to the first part of a question to get credit for the second part as indicated. Use calculators and/or laptop to do calculations. (But don't ask me how your equipment works!) You are not allowed to use the internet/communication capability of your equipment.

Write answers in exam books.

## QUIZ 2

1.  $X$  is known to be normally distributed with mean 0 and unknown variance  $\sigma^2 = \theta$ . From a sample of 5 you get the numbers -10,7,-1,8,12.

- (1) (5pts) Find the MLE estimator and estimate for  $\theta$ .
- (2) (5pts) Is your estimator unbiased? Explain.
- (3) (5pts) Assuming that your estimator is unbiased, find the Cramér-Rao lower bound for its variance.

2.  $Y$  is taken from a uniform distribution which goes from  $-\theta$  to  $2\theta$ . So its density function is  $f(y) = \frac{1}{3\theta}$  if  $-\theta \leq y \leq 2\theta$  and  $f(y) = 0$  otherwise. Given a sample of 5 you get -5,2,4,-9,17.

- (1) (5pts) Find the MOM estimator and estimate for  $\theta$
- (2) (5pts) The MLE is the smallest possible value of  $\theta$  given the data. Find  $\hat{\theta}_{MLE}$ . Explain why this is the MLE.
- (3) (5pts) The MLE is sufficient for  $\theta$ . Explain what this means.

3. (extra credit) Please go over your answers to the first part before attempting the extra credit problems.

(5pts) In the previous problem, the MOM is unbiased and the MLE is sufficient. Can you combine them using the Rao-Blackwell formula?

(5pts) Find the 95% confidence interval for  $\sigma^2$  in the first problem.