

## Worksheet 09

1. Find the MLE estimator for the estimation of the parameter  $\lambda$  from i.i.d. observations of an exponentially distributed random variable.
2. Find the MLE estimator for the estimation of the variance from i.i.d. observations of an exponentially distributed random variable. Hint: This is easily derived from the previous result. Should not require any new derivatives.
3. Find the MLE estimator for the estimation of the parameter  $p$  from i.i.d. observations of a Bernoulli distributed random variable. Hint: When you set the derivative equal to zero, multiple by  $\frac{1}{n}$  to write the equation in terms of just  $\bar{X}$  and  $\hat{p}$ .
4. Find the MLE estimator for the estimation of the parameters  $\mu$  and  $\sigma^2$  from i.i.d. observations of a normally distributed random variable. Hint: We want to think of  $\sigma^2$  as a single parameter (not the square of a parameter). I recommend using  $v = \sigma^2$  to keep this clear. Also, find  $\hat{\mu}$  first. You can find the MLE for the mean without knowing the MLE of the variance.
5. What is the bias of the MLE estimator for the variance from a normal distribution with unknown mean and variance? Hint: Use what we know about  $S_X^2$  to make this relatively easy.