

## Worksheet 20

1. Find the Jeffreys prior for estimating the mean of a normal distribution with a known variance  $\sigma^2$ . You can assume we have only one observation  $X$ . What is the corresponding Bayesian point estimator and how does it compare to the MLE?

2. Find the Jeffreys prior for estimating the parameter  $p$  from a Binomial with a known value  $n$ . What is the corresponding Bayesian point estimator? What does this mean in the case when  $n = 1$  and  $X = 0$  and in the case when  $n = 1$  and  $X = 1$ ?

3. Find the Jeffreys prior for estimating the parameter  $\lambda$  from a Poisson. Write down a formula that gives, up to a constant, the posterior distribution. Note that you will not be able to relate this to a known distribution on our chart.

4. The Fisher information for the geometric distribution is  $\mathcal{I}(p) = \frac{(1-p)}{p^2}$ . Find the Jeffreys prior for estimating the parameter  $p$  from a geometric distribution. What is, more-or-less, this distribution?<sup>1</sup> What is the corresponding Bayesian point estimator? Using previous results, you should be able to do this for a sample of size  $n$ .

<sup>1</sup> It should line up with one of the results on the table, but the hyper-parameter is out of bounds. That's okay though. It just means we have an improper prior. All of the results still hold.