Exercises 1

First lecture

1. Placenta previa is considered one of the obstetric emergencies in the third trimester of pregnancy, especially during delivery. Anatomically, the placenta comes in front of the fetal presentation part. It can be a cause of severe bleeding.

   We are interested in estimation of the proportion θ of *female* births in the population of the placenta previa births.

   Data: a study in Germany found that of $n = 980$ placenta previa births, $x = 437$ were female.

   - Plot the relative likelihood function for θ
   - Find the maximum likelihood estimate (MLE)
   - Is $\theta < 0.485$, the proportion of female births in the general population? Try to answer to the question using the likelihood
   - Compute the observed information at the MLE.

2. Consider observations $(Y_1, \dots, Y_n)$ independent and identically distributed like a Poisson

$$f(y; \lambda) = \frac{e^{-\lambda}\lambda^y}{y!}.$$

   Find the log-likelihood and the MLE of λ.