Laboratory Session 06 : May 5, 2021

Exercises due : May 23, 2021

Exercise 1

- the number of particles emitted by a radioactive source during a fixed interval of time (Δt = 10 s) follows a Poisson distribution on the parameter μ. The number of particles observed during consecutive time intervals is: 4, 1, 3, 1 and 3

(a) suppose a uniform prior distribution for the parameter μ

- determine and draw the posterior distribution for μ, given the data
- evaluate mean, median and variance, both analytically and numerically in R

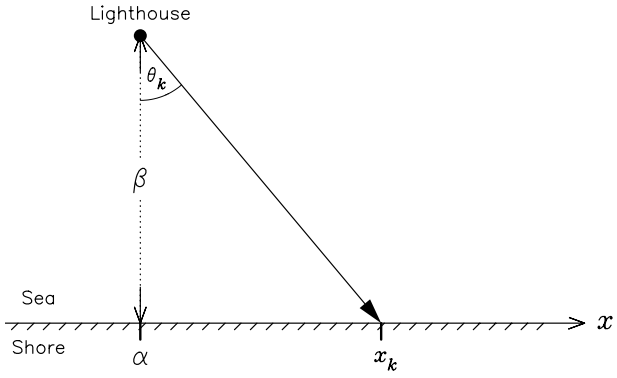
(b) suppose a Jeffrey's prior for the parameter μ

- determine and draw the posterior distribution for μ, given the data
- evaluate mean, median and variance, both analytically and numerically in R

(c) evaluate a 95% credibility interval for the results obtained with both priors. Compare the result with that obtained using a normal approximation for the posterior distribution, with the same mean and standard deviation

Exercise 2

- given the problem of the lightouse discussed last week, study the case in which both the position along the shore (α) and the distance out at sea (β) are unknown



Exercise 3

- given the Signal over Background example discussed last week, analyze and discuss the following cases:

(a) vary the sampling resolution of used to generate the data, keeping the same sampling range

```
xdat <- seq(from=-7*w, to=7*w, by=0.5*w)
```

- change the resolution $w = \{0.1, 0.25, 1, 2, 3\}$
- Check the effect on the results

(b) change the ratio A/B used to simulate the data (keeping both positive in accordance with the prior)

- Check the effect on the results