

Exercises - May 27 2019

Exercise 1

- the number of British coal mine disasters has been recorded from 1851 to 1962. By looking at the data it seems that the number of incidents decreased towards the end of the sampling period. We model the data as follows:
 - before some year, we call τ , the data follow a Poisson distribution, where the logarithm of the mean value, $\log \mu_t = b_0$, while for later years, we can model it as $\log \mu_t = b_0 + b_1$
- the dependence can be modeled as follows $y_t \sim \text{Pois}(\mu_t)$, where $\log \mu_t = b_0 + b_1 \text{Step}(t - \tau)$
- implement the model in **jags**, trying to infer the parameters b_0 , b_1 and τ
- the step function is implemented, in BUGS, as **step(x)** and return 1 if $x \geq 0$ and 0 otherwise
- assign a uniform prior to b_0 , b_1 and a uniform prior in the interval $(1, N)$, where $N = 112$ is the number of years our data span on
- finally, here is our data:

```
data <- NULL
data$D <- c(4,5,4,1,0,4,3,4,0,6,
  3,3,4,0,2,6,3,3,5,4,5,3,1,4,4,1,5,5,3,4,2,5,2,2,3,4,2,1,3,2,
  1,1,1,1,1,3,0,0,1,0,1,1,0,0,3,1,0,3,2,2,
  0,1,1,1,0,1,0,1,0,0,0,2,1,0,0,0,1,1,0,2,
  2,3,1,1,2,1,1,1,1,2,4,2,0,0,0,1,4,0,0,0,
  1,0,0,0,0,0,1,0,0,1,0,0)
data$N <- 112
```

- before running **jags**, assign an initial value to the parameters as follows: $b_0 = 0$, $b_1 = 0$ and $\tau = 50$
- explore the features of the chains and try to understand the effects of the burnin, and thinning
- plot the posterior distributions of the parameters and extract their mean values, and 95