# Module 5: Exercises

## Data

First recreate the same artificial dataset `x` as in the supplementary material (note the `set.seed()` command):

```
mu_true <- 250
tau_true <- 1/5^2
n <- 30
set.seed(42)
x <- rnorm(n, mean = mu_true, sd = sqrt(1/tau_true))
x_bar <- mean(x)
```

## Exercise 1

Now, assume the researcher a priori (before seeing any data/people) is sure that she/he is in a land of tiny people, and chooses the following parameters for the priors for the mean and precision (still product of normal and gamma distribution):

```
tau_prior <- 1/10^2
mu_prior <- 50
alpha_prior <- 10
beta_prior <- .002
```

Rerun the Gibbs sampler from the supplementary material (with the same updating scheme: first $\mu$ then $\tau$) with these prior parameters and comment on the marginal distribution of $\mu$ (and $\tau$ if you like).

## Exercise 2

Now rerun the Gibbs sampler from the supplementary material with the opposite updating scheme – first $\tau$ then $\mu$ – and comment on the marginal distribution of $\mu$ (and $\tau$ if you like).

## Exercise 3

Try to explain the different results you obtained in exercises 1 and 2 by looking at the posterior we are trying to sample from. **Don't spend too much time on this** – it is difficult, and you will probably have to consider the logarithm of the posterior to be able to identify the problem: Instead consult the solution if you find it too difficult.

## Exercise 4

Now generate additional 70 data points (people) from the population (still N(250, 0.04)) and rerun the analysis from exercise 1 with this new dataset of 100 people (**remember** to update the global variables `n` and `x_bar`). Comment on the results.

## Exercise 5

Based on the posterior simulations in exercise 4 estimate the probability of $\mu < 249$.