Applied Bayesian modeling - HW3, V1

I am posting the HW-V1 to have questions to work on in class on 9/22/after watching module 6. Note that there may be additional questions added later.

Exercise 1: Fit a Bayesian model using brm and check and interpret the output

We continue with IQ data, as introduced in HW2. For this HW, data set iq_scores.csv contains 10 iq-scores, sampled from a town in let's say, your favorite country.

Use brm to fit the following model to the IQ data:

$$\begin{aligned} y_i|\theta_i,\sigma^2 &\sim N(\theta_i,\sigma^2)(\text{independent}), \text{ for } i=1,2,\ldots,n; \\ \mu &\sim N(100,15^2); \\ \sigma &\sim \text{use the brm-default.} \end{aligned}$$

Then answer the following questions:
(i) Plot a histogram of the posterior samples of μ and report a posterior point estimate and 80% CI for μ.
(ii) Plot a histogram of the posterior samples of σ and report a posterior point estimate and 80% CI for σ.
(iii) Can you report a posterior point estimate and 80% CI for μ/σ? If yes, do so. If not, why not?

Note that the prior for μ can be specified with an additional argument in brm (as illustrated in optional material in module 5), as follows:

```
#mu_prior <- set_prior("normal(100,15)", class = "Intercept")
#fit  <- brm(y ~ 1, prior = c(mu_prior),
#            your other usual arguments)
```

Exercise 2: Compare and contrast the MCMC diagnostics of two different model fits

Continue with the IQ data from Q1 (with y= IQ scores) to fit the model as specified below. Present and briefly summarize resulting MCMC diagnostics for μ (traceplots, Rhat, effective sample sizes). Then and comment on whether this model fit can be used for summarizing information regarding μ. If not, why not?

```
#fit_bad <- brm(y ~ 1, data = dat,
#         chains = 4, iter = 200, cores = getOption("mc.cores", 4),
#         control = list(adapt_delta = 0.6, max_treedepth = 4)
#          # these are NOT recommended options, trying to create problems here!
#         )
```