Exercise 1

This exercise explores the off-line components available in **mirtCAT** that are useful for a) understanding the properties of CATs underling various circumstances, b) testing existing item banks given overt response patterns, and c) studying CATs with Monte Carlo simulations. Specifically, this exercise consists of building and studying a unidimensional CAT using known IRT parameters.

Question 1

The first step is to build a suitable CAT with **mirtCAT** given a priori item parameters is to use the `generate.mirt_model()` function. Generate a unidimensional CAT consisting of 200 items, each of which follow a 3PL model, given the following specifications:

- Slope parameters (`a1`) are drawn from a log-normal distribution ($\ln \mu = .2$, $\ln \sigma = .2$)
- Intercepts (`d`) are drawn from a Gaussian distribution with ($\mu = 0$, $\sigma = 2$)
- Pseudo-guessing parameters (`g`) are drawn from a beta distribution with $\alpha = 20$ and $\beta = 80$ (note that R calls these 'shapes')

Given these simulated parameters, construct a suitable model with `generate.mirt_model()`.

Question 2

Inspect this newly constructed model with functions such as `coef()` and `plot()` to get a feel for how the CAT will behave. Note that modifying the `type` argument in combination with `which.items` will be helpful for presentation because of the larger number of items in the test.

Question 3

Given the constructed model, generate a plausible response pattern for a participant with the ability $\theta = 0.5$ using the `generate_pattern()` function.

After generating this pattern, supply the vector of responses to `mirtCAT()` and administer the items sequentially while estimating $\hat{\theta}$ using a MAP estimator. However, modify the inputs such that *all* the items are answered (hint: modify the `min_items` or `min_SEM` argument). Summarize and plot the CAT session results.

Question 4

Re-run your generated response pattern with `mirtCAT()`, however use the maximum-information selection criteria (`'MI'`) instead (with an `MI` starting item as well). Terminate the test when either $SE(\hat{\theta}) < .3$ or the number of items is equal to 40. Summarize and plot the results again for this new session.

Compare the SEs to the SEs in the previous question where all the items where administered in sequence. What do you notice about the general behavior?

Question 5

Save your model object to your hard-drive using either `save()` or `saveRDS()`. We will use this object again in a later example.