These are review questions that you can use to self-study the material. Some are difficult, others are fairly straightforward. You can find most of the answers to these questions in the slides. Enjoy!

**Sequential Monte Carlo**

**Q1.** What are the three steps in each iteration of a SMC algorithm? Why is the selection step needed? Why is the mutation step needed?

**Q2.** What is the difference between likelihood tempering and data tempering? What are the advantages and disadvantages of the two tempering schemes?

**Q3.** Does the tuning parameter $\lambda$ affect the number of required likelihood evaluations?

**Q4.** What would be the advantage of executing multiple Metropolis-Hastings steps during the mutation phase?

**Q5.** In the book we recommend to initialize the SMC with draws from the prior distribution. What are potential advantages and disadvantages of this initialization?

**Q6.** Provide an outline for a recursive proof that shows that the SMC approximation $\bar{h}_N$ converges almost surely to $E_{\pi}[h]$.

**Particle Filters**

**Q1.** What is the difference between the bootstrap particle filter and the conditionally-optimal particle filter?

**Q2.** Can the conditionally-optimal particle filter be implemented in a nonlinear DSGE model?

**Q3.** Why is the resampling step needed in the particle filter?

**Q4.** TRUE or FALSE: the smaller the measurement error in the state-space representation, the more accurate the particle filter approximation. Explain.

**Q5.** How do outliers in your sample affect the accuracy of particle filter approximations?

**Q6.** Is the particle filter approximation of the likelihood function unbiased? Why do we care?