Lesson 6

Quiz, 8 questions

8/8 points (100%)

Congratulations! You passed!

Next Item

1 / 1 points

1. Why is it important to check your MCMC output for convergence before using the samples for inference?

- [ ] You can cut your Monte Carlo error by a factor of two if you strategically select which samples to retain.
- [x] If the chain has not reached its stationary distribution (the target/posterior), your samples will not reflect that distribution.

Correct
Monte Carlo samples from the incorrect distribution will likely produce misleading results.

- [ ] Pre-convergence MCMC samples are useless.
- [ ] Convergence diagnostics provide a guarantee that your inferences are accurate.

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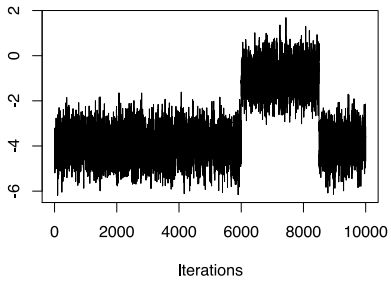
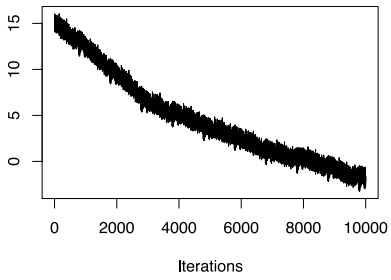
1 / 1 points

2. Which of the following trace plots illustrates a chain that appears to have converged?

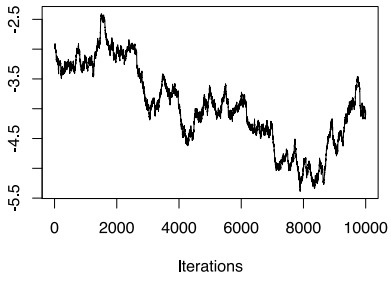
A)



B)



C)



- [x] D)

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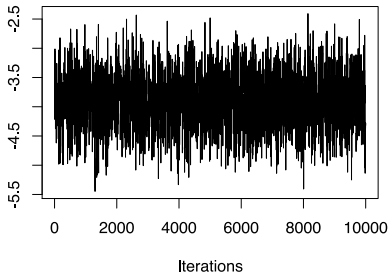
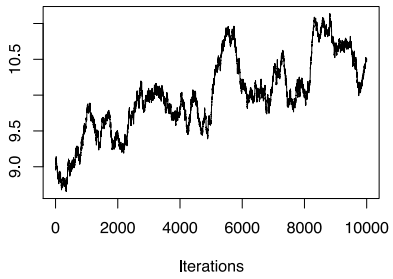


8/8 points (100%)

Correct
This chain shows no obvious trends or jumps, and appears to be moving around freely in what we anticipate is the target distribution.

✔ 1 / 1 points

3. The trace plot below was generated by a random walk Metropolis sampler, where candidates were drawn from a normal proposal distribution with mean equal to the previous iteration's value, and a fixed variance. Based on this result, what action would you recommend taking next?



- The step size of the proposals is too **small**. **Decrease** the variance of the normal proposal distribution and re-run the chain.
- ◉ The step size of the proposals is too **small**. **Increase** the variance of the normal proposal distribution and re-run the chain.

Correct
In other words, it takes too long for the chain to explore the posterior distribution. This is less of a problem if you run a *very* long chain, but it is best to use a more efficient proposal distribution if possible.

- The step size of the proposals is too **large**. **Decrease** the variance of the normal proposal distribution and re-run the chain.
- The step size of the proposals is too **large**. **Increase** the variance of the normal proposal distribution and re-run the chain.

✔ 1 / 1 points

4. Suppose you have multiple MCMC chains from multiple initial values and they appear to traverse the same general area back and forth, but struggle from moderate (or high) autocorrelation. Suppose also that adjusting the proposal distribution q is not an option. Which of the following strategies is likely to help increase confidence in your Monte Carlo estimates?

- Discard fewer burn-in samples to increase your Monte Carlo effective sample size.
- Add more chains from more initial values to see if that reduces autocorrelation.
- ◉ Run the chains for *many* more iterations and check for convergence on the larger time scale.

Correct
Proper MCMC algorithms come with a theoretical guarantee of *eventual* convergence to the target distribution. Chains with very high autocorrelation may require an impractical number of iterations, but it is worth checking to see if a longer chain yields acceptable results.

- Retain only the 80% of samples closest to the maximum likelihood estimate.

✔ 5.

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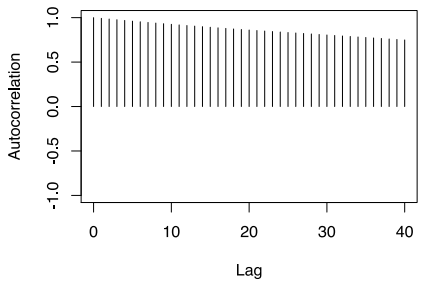
1 / 1 points

Each of the following plots reports estimated autocorrelation from a MCMC chain with 10,000 iterations. Which will yield the lowest Monte Carlo effective sample size?

8/8 points (100%)

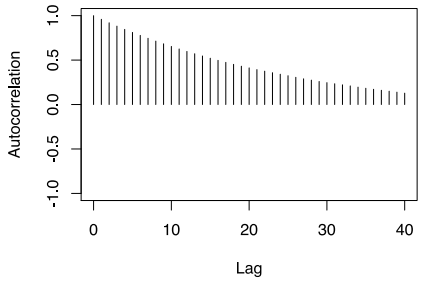
A)



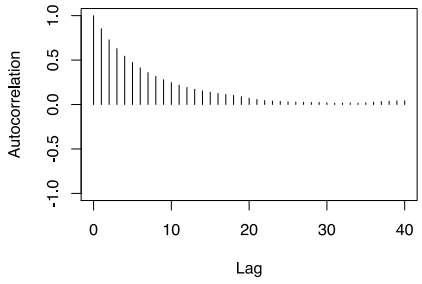
Correct

High autocorrelation leads to low MCMC effective sample size.

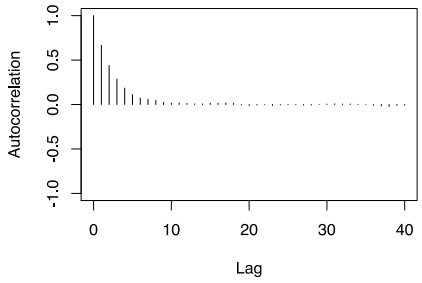
B)



C)



D)



1 / 1 points

6. The following trace plot shows four chains with distinct initial values. Of the choices given, what is the lowest number of samples you would comfortably recommend to discard as burn-in?

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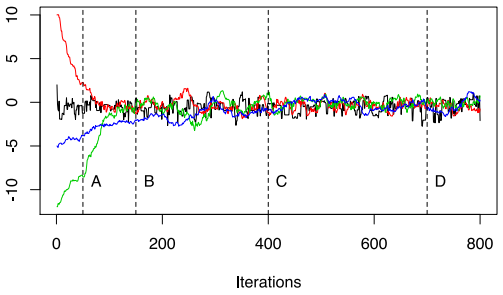

- A: 50 iterations
- B: 150 iterations
- C: 400 iterations

Correct
The chains have been exploring the same space for some time now, and it is probably pretty safe to start retaining samples.

- D: 700 iterations

✔ 1 / 1 points

7. Suppose the Gelman and Rubin diagnostic computed from multiple chains reports a scale reduction factor much higher than 1.0, say 8.0. What is the recommended action?

- Thin the chain by discarding every eighth sample.
- Discontinue use of the model, since there is little hope of reaching the stationary distribution.
- Use the samples for inference as this high scale reduction factor indicates convergence.
- Continue running the chain for *many* more iterations.

Correct
A high scale reduction factor indicates that the chains are not yet exploring the same space, so we need to provide them more iterations to converge.

✔ 1 / 1 points

8. Which of the following Monte Carlo statistics would require the largest MCMC effective sample size to estimate reliably? Assume the target distribution is unimodal (has only one peak).

- Mean of the target distribution
- 15 percentile of the target distribution
- Median of the target distribution
- 97.5 percentile of the target distribution

Correct
The outer edges of the distribution are sampled less frequently and therefore susceptible to changes between simulations. The Raftery and Lewis diagnostic can help you decide how many iterations you need to reliably estimate outer quantiles of the target distribution.
