Problem 1:

1. FALSE→ The solution of the stochastic integral ​ is equal to only when *μ* is a constant and is a random variable itself.
2. FALSE → The variance of a Wiener process with scale coefficient *σ*=1 at time *t* is *t.*
3. TRUE
4. FALSE → The first passage time distribution often lacks a closed-form probability density function and typically requires numerical methods for evaluation.
5. FALSE → The Euler-Maruyama method can be used to simulate both linear and nonlinear stochastic systems represented by stochastic differential equations.
6. FALSE → It is not necessarily true that the prior will always have a smaller variance than the posterior. In some cases, the prior distribution might have a larger variance than the posterior, especially if the data strongly contradict the prior beliefs.
7. TRUE
8. TRUE
9. FALSE → MCMC methods do not approximate the posterior distribution with a simpler distribution but rather directly sample from the posterior distribution itself.
10. FALSE → The Monte Carlo Standard Error (MCSE) in the context of MCMC estimation is computed by dividing the standard deviation of the chains by the square root of the effective number of samples. A smaller number of independent samples may carry the same amount of information as the actual number of samples.
11. TRUE
12. TRUE

Problem 2: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 3: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 4:

Note from HW1:

Problem 5: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 6: Solution is in the corresponding Jupyter notebook on the GitHub.

Problem 7: Solution is in the corresponding Jupyter notebook and diffusion\_model.stan on the GitHub.