Note:

1. The problems are from the textbook by G. H. Givens and J. A. Hoeting
2. There are total 2 questions: 6.7 and 6.8.
3. The full grade is 10 in this HW with point distributed as

6.7 (a)	1
(b)	2
(c)	1
(d)	1
(e)	1
6.8	4

6.7. Consider pricing a European call option on an underlying stock with current price $S^{(0)} = 50$, strike price $K = 52$, and volatility $\sigma = 0.5$. Suppose that there are $N = 30$ days to maturity and that the risk-free rate of return is $r = 0.05$.

   a. Confirm that the fair price for this option is 2.10 when the payoff is based on $S^{(30)}$ [i.e., a standard option with payoff as in (6.74)].

   b. Consider the analogous Asian option (same $S^{(0)}$, K, σ, N, and r) with payoff based on the arithmetic mean stock price during the holding period, as in (6.77). Using simple Monte Carlo, estimate the fair price for this option.

   c. Improve upon the estimate in (b) using the control variate strategy described in Example 6.13.

   d. Try an antithetic approach to estimate the fair price for the option described in part (b).

   e. Using simulation and/or analysis, compare the sampling distributions of the estimators in (b), (c), and (d).

6.8. Consider the model given by $X \sim \text{Lognormal}(0, 1)$ and $\log Y = 9 + 3 \log X + \epsilon$, where $\epsilon \sim N(0, 1)$. We wish to estimate $E\{Y/X\}$. Compare the performance of the standard Monte Carlo estimator and the Rao–Blackwellized estimator.