BONUS Week 10 Homework

This is a preview of the published version of the quiz

Started: Jul 2 at 7:54am

Quiz Instructions

Question 1

Cats = C $P(C)=0.6$ $C \sim N(12,4) = N(12, 2^2)$
Dogs = D $P(D)=0.4$ $D \sim N(30,25) = N(30, 5^2)$

1 pts

(Lesson 7.11: Composition.) BONUS: It's Raining Cats and Dogs is a pet store with 60% cats and 40% dogs. The weights of cats are Nor(12,4), and the weights of dogs are Nor(30,25). How would we use composition to simulate the weight W of a random pet from the store? (Let $\Phi(\cdot)$ denote the standard normal c.d.f., and let U_i's denote PRN's.)

- a. $W = 0.6(12 + 4\Phi^{-1}(U_1)) + 0.4(30 + 25\Phi^{-1}(U_2))$
- b. $W = 0.6(12 + 2\Phi^{-1}(U_1)) + 0.4(30 + 5\Phi^{-1}(U_2))$
- c. If $U_1 < 0.6$, then $W = 12 + 4\Phi^{-1}(U_2)$; otherwise, $W = 30 + 25\Phi^{-1}(U_2)$
- d. If $U_1 < 0.6$, then $W = 12 + 2\Phi^{-1}(U_2)$; otherwise, $W = 30 + 5\Phi^{-1}(U_2)$
- e. If $U_1 < 0.4$, then $W = 12 + 4\Phi(U_2)$; otherwise, $W = 30 + 25\Phi(U_2)$

Question 2

1 pts

(Lesson 7.15: Baby Stochastic Processes.) BONUS: Consider a Markov chain in which $X_i = 0$ if it rains on day i; and otherwise, $X_i = 1$. Denote the day-to-day transition probabilities by

$$P_{jk} = \Pr(\text{state } k \text{ on day } i \mid \text{state } j \text{ on day } i-1), \quad j,k = 0,1.$$

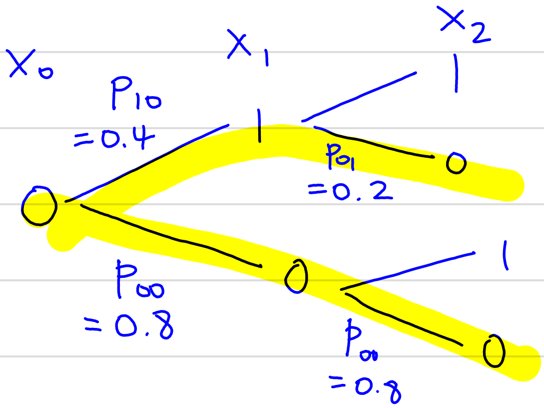
Suppose that the probability state transition matrix is

$$\mathbf{P} = \begin{pmatrix} 0.8 & 0.2 \\ 0.4 & 0.6 \end{pmatrix}.$$

$P_{00} = 0.8$ $P_{10} = 0.4$
$P_{01} = 0.2$ $P_{11} = 0.6$

Suppose that it rains on Monday, e.g., $X_0 = 0$. Use simulation to find the probability that it rains on Wednesday, e.g., estimate $\Pr(X_2 = 0 | X_0 = 0)$. [You may have to simulate the process a bunch of times in order to estimate this probability.]

- a. 0
- b. 0.64
- c. 0.72 ✓
- d. 0.8
- e. 1



$0.4(0.2) + 0.8(0.8)$

$= \frac{18}{25} = 0.72$

Question 3

1 pts

(Lesson 7.17: Time Series Generation.) BONUS: Suppose that $Y_0 \sim \text{Nor}(0, 1)$ and consider the time series $Y_i = 0.7Y_{i-1} + \epsilon_i$, $i = 1, 2, \ldots$, where the ϵ_i's are i.i.d. Nor$\left(0, 1 - (0.7)^2\right)$. (The funny variance of ϵ_i guarantees that $Var(Y_i) = 1$ for all i). Use simulation to find $Cov(Y_2, Y_5)$. Hint: Simulate $Y_0, Y_1, \ldots, Y_5$ many times. For each run of the simulation, save the pair (Y_2, Y_5). Then use those pairs to estimate the covariance.

This is AR(1)

$Y_i = \underset{\uparrow \atop \phi}{0.7} Y_{i-1} + \varepsilon_i \quad , \quad i = 1, 2, \ldots$

- a. 0
- b. 0.7
- c. 0.49
- d. 0.7^3 ✓
- e. 0.7^4

$cov(Y_i, Y_{i+k}) = \phi^{|k|}$

$cov(Y_2, Y_{2+3}) = \phi^{|3|} = 0.7^3$

Not saved

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