Stat 100a midterm, Prof. Rick Paik Schoenberg, 12/11/17, 11am-12:15pm.

1. You may start the exam immediately.
2. Ignore my original instructions about emailing me back separately with a copy of your exam. Instead, just email me back to frederic@stat.ucla.edu with
Your name.
Your student ID number.
Your answers to the questions, 5 at a time, in the form abcad bbaed ccbce a.
Be sure to email me as soon as the exam time is over. Late exams will be penalized, and if your email arrives more than 5 min late you will receive a score of zero.
3. You may use any books, notes or calculator during the exam but you are not allowed to communicate with anyone other than me during the exam and you are not allowed to browse the internet during the exam. Cooperating or communicating with others during the exam is cheating and I will notify the Dean of Students about suspected cheaters so they can be disciplined.
4. If you have a question during the exam, please email me your question to frederic@stat.ucla.edu and I will respond as soon as possible.
5. There are 16 multiple choice questions worth 6.25% each.
6. No partial credit is given for multiple choice questions. Choose ONE answer only.
7. Final numerical answers have been rounded to 3 significant digits.

1. Let $X = N(0, 0.1^2)$ and let $\varepsilon = N(0, 0.2^2)$ where ε is independent of X. If $Y = 5 - 2X + \varepsilon$, what is cov(X,Y)?
a. 0. b. -0.02. c. 0.01. d. -0.03. e. None of the above.

2. If (X,Y) are bivariate normal with E(X) = 20, var(X) = 16, E(Y) = 40, var(Y) = 9, and $\rho = 0.4$, what is the distribution of Y given X = 25?
a. $N(40.7, 2.12^2)$. b. $N(40.7, 2.75^2)$. c. $N(41.5, 2.12^2)$. d. $N(41.5, 2.75^2)$. e. None of the above.

3. Consider a 2,3,4,5, or 6 to be a "small card". Suppose X is the number of small cards in your hand, and Y is the number of 2s in your hand. By "hand", I mean your two cards. What is cov(X,Y)?
a) 0.0928 b) 0.107 c) 0.180. d) 0.214. e) None of the above.

4. Let X be the number of hands you play until you get pocket aces for the 15th time. What is the standard deviation of X?
a) 697. b) 792. c) 854. d) 907. e) None of the above.

5. Suppose you know that your opponent would go all in before the flop with 50% probability if she had AK, AQ, or AJ, and she would go all in before the flop with 20% probability if she had a pocket pair. With other hands, there is 0% probability that she would go all in before the flop. Given that she has gone all in before the flop, and given no other information about her cards or her opponents' cards, what is the probability that she has a pocket pair?
a) 25.2%. b) 39.4%. c) 43.2%. d) 48.2%. e) None of the above.

6. Suppose we take a poker player who has an expected daily profit of $1, and a standard deviation of $50. Over a 100 day period, she gets very lucky and wins a total of $2,000, for an average of $20 per day. Which of the following is true, based on the law of large numbers, if she keeps playing indefinitely?
a) Her $2,000 in winnings will be cancelled out by $2,000 in future losses in the next 100 days, after which her profit will be steady at $1 per day.
b) We expect her short term good luck over the 100 days to be cancelled out by short term bad luck over the next 100 days.
c) Her $2,000 in winnings will eventually become negligible compared to her later winnings and losses, and her average profit will ultimately converge to $1 per day.
d) The expected value of her profit over the next 100 days is $-1,800, which will make her total profit over these 200 days equal to $200.
e) None of the above.

7. Suppose X and Y are independent random variables, where X is uniform on (0,1), and Y is exponential with mean 1/3. Let $Z = \min\{X,Y\}$. Let f(c) denote the pdf of Z. What is f(1/6)? (You may use the approximation $e \sim 2.718$.)
a) 2.12. b) 3.01. c) 4.42. d) 5.07. e) None of the above.

For the next two questions, in a given hand of holdem, let X = the number of kings in your hand and Y = the number of queens in your hand. By "hand", I mean your two cards.

8. What is P{E[Y|X] = 1/12}?
a) 10.2%. b) 14.5%. c) 22.2%. d) 25.4%. e) None of the above.

9. What is cov{X,Y}?
a) -.0116. b) -.0138. c) -.0173. d) -.0198. e) None of the above.

For the next 2 questions, you have J♥ 10♦, your opponent has 9♠ 9♦, and the flop is Q♣ J♠ 10♣. The pot is $50. The turn is 4♣, you bet $20, and your opponent calls.

10. If your opponent wanted to maximize her number of chips, and if she knew exactly what you had, should she have called your $20 bet on the turn?
a) Yes, because her probability of winning was 29.2% which is bigger than 20/70.
b) Yes, because her probability of winning was 22.7% which is bigger than 20/90.
c) No, because her probability of winning was 22.7% which is smaller than 20/70.
d) No, because her probability of winning was 17.1% which is smaller than 20/90.
e) None of the above.

11. How much expected profit in dollars did you gain due to skill on the turn?
a) 7.20. b) 8.72. c) 9.34. d) 10.9. e) None of the above.

For the next 2 questions, suppose your daily profits, over 400 days, are independent of one another and your total profit over the 400 days is $1200. The standard deviation of your daily profit is $100.

12. Find a 95% confidence interval for your longterm average daily profit.
a) $3 +/- 3.02. b) $3 +/- 6.53. c) $3 +/- 7.02. d) $3 +/- 9.80. e) None of the above.

13. How many MORE daily observations, rounded to the nearest integer, would be needed for the 95% confidence interval for your mean daily profit not to contain zero, if you keep winning at the same rate?
a) 3868. b) 5713. c) 8704. d) 9283. e) None of the above.

14. Suppose you start with 1 chip at time 0 and that your tournament is like a simple random walk, but if you hit 0 you are done. What is P(you have not hit zero by time 59)?
a) 8.04%. b) 10.3%. c) 12.4%. d) 14.7%. e) None of the above.

15. In a given winner take all tournament with 8 players, each player pays $10 to enter and starts with 3 chips. Each hand, a player either wins a chip or loses a chip. Because of your great skill, each time, you gain a chip with probability p = 55% and you lose a chip with probability q = 45%. What is your expected profit from playing in the tournament?
a) $26.5. b) $27.3. c) $28.0. d) $29.4. e) None of the above.

16. What is the probability that none of the suits of the 3 cards on the flop matches either of your 2 hole cards? For instance, if you have 2♠ 3♦, and the flop is 3♠ Q♥ Q♣, then we would say at least one of the flop cards has a suit matching your hole cards (the 3♠ matches the 2♠). But if you have 2♠ 3♦, and the flop is 3♣ Q♥ Q♣, then none of the suits on the flop matches your hole cards.
a. 17.8%. b. 18.5%. c. 21.1%. d. 23.6%. e. None of the above.