STA 256f18 Assignment Four[1]

Please read Section 2.1 in Chapter 2 in the textbook and look over your lecture notes. These homework problems are not to be handed in. They are preparation for Term Test 2 and the final exam. All textbook problems are from Chapter Two. Use the formula sheet to do the problems. On tests and the final exam, you may use anything on the formula sheet unless you are being directly asked to prove it.

1. Roll two fair dice, and let X be the minimum of the two numbers showing.
   (a) Give $p(k)$ and $F(x)$ for $k = 1, \ldots, 6$.
   (b) What is $F(1)$?
   (c) What is $F(3)$?
   (d) What is $F(3.5)$?
   (e) What is $p(3.5)$?
   (f) What is $F(0)$?
   (g) What is $p(0)$?
   (h) What is $F(-14)$?
   (i) What is $F(14)$?
   (j) What is $p(14)$?
2. Do Problem 1 in the text. Note that the cumulative distribution function is continuous from the right, so your graph of $F(x)$ should *not* look like Fig. 2.2 on p. 37.
3. Do Problem 2 in the text, part (c) only.
4. Do Problem 3 in the text.
5. Let the discrete random variable X have probability mass function $p(x) = c\,x^2$ for $x = -2, -1, 0, 1, 2$ and zero otherwise. What is the constant c?
6. Let the discrete random variable X have probability mass function $p(x) = c\,\frac{2^x}{x!}$ for $x = 0, 1, \ldots$ and zero otherwise. What is the constant c?
7. Do Problem 7 in the text. A Bernoulli random variable is a Binomial with $n = 1$ (see the formula sheet).
8. Do Problem 8 in the text.

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9. A jar contains 14 red balls and 6 green balls. Five balls are randomly selected from the jar. What is the probability of selecting exactly three green balls if the sampling is

   (a) With replacement?

   (b) Without replacement?

   The answers are numbers.

10. A jar contains 6 red balls and 4 blue balls. Balls are randomly selected one by one, with replacement. What is the probability that the third blue ball selected is observed on the fifth draw?

11. Suppose that given your current driving habits and other characteristics, the chances of being stopped by police on any given day are three percent, and events on different days are mutually independent. What is the probability of being stopped for the first time this month on day five? The answer is a number.

12. Do Problem 11 in the text.

13. Do Problem 12 in the text.

14. Show that the geometric probabilities sum to one.

15. Do Problem 15 in the text. This is a good question if you are interested in the outcomes of sports playoffs. The trick here, say for the best 3 out of 5 series, is to imagine that the teams are going to keep playing until Team A wins three times. If it takes more than five games, that just means that Team B wins. My answer for the probability of Team A winning a 5 game series is 0.31744.

16. Do Problem 17 in the text. Hint: let $Y = X - 1$ and obtain $P(Y = y)$ from $P(X = x)$. For what values of y is $P(Y = y)$ nonzero?

17. Do Problem 18 in the text.

18. Do Problem 19 in the text.

19. Do Problem 20 in the text.

20. Do Problem 21 in the text. This is like the memoryless property of the exponential.

21. Show that the Poisson probabilities sum to one. This *is* as easy as it seems.

22. Let X be a binomial (n, p) random variable. Let $n \to \infty$ and $p \to 0$ in such a way that the value of $np = \lambda$ remains fixed. Show that the probability mass function of X approaches the probability mass function of a Poisson as $n \to \infty$. This is called the Poisson approximation to the binomial. It is given at the beginning of Section 2.1.5 in the text, but the book's derivation is not complete. Supply the missing details.

23. Use the Poisson approximation to the binomial to do Problem 26 in the text. I get 0.771, 0.2, 0.026.

24. Do Problem 31 in the text.

25. Do problem 32 in the text.
