Introduction to Probability

Math 30530, Section 01 — Fall 2012

Homework 6 — due Friday October 26

General information: Homework is an essential part of your learning in this course, so please take it very seriously. It is extremely important that you keep up with the homework, as if you do not, you may quickly fall behind in class and find yourself at a disadvantage during exams.

You should treat the homework as a learning opportunity, rather than something you need to get out of the way. Reread and revise your solutions until they are correct and concise. This will help deepen your understanding of the material. I encourage you to talk with your colleagues about homework problems, but your final write-up must be your own work.

You should present your final homework solutions clearly and neatly. Keep in mind that when you write a homework solution, you are trying to communicate the solution to someone other than yourself, so incomplete sentences and personal shorthand is not helpful!

I plan to quickly post solutions to all the problems after I've collected them up.

Reading:

- Chapter 17
- Chapter 18
- Chapter 23
- Chapter 24

Problems: (**GW** indicates that the problem is taken from the course textbook by Gundlach and Ward; for some of these problems, you may want to use online probability calculators such as those at `http://www.stat.tamu.edu/~west/applets/binomialdemo.html` and `http://stattrek.com/online-calculator/poisson.aspx`)

1. **GW** 17.2
2. **GW** 17.5
3. **GW** 17.7
4. **GW** 17.13
5. **GW** 17.22a
6. **GW** 18.10
7. **GW** 18.18
8. **GW** 18.21
9. **GW** 24.1
10. **GW** 24.4 a, b, c, g, h only
11. **GW** 24.20
12. **GW** 24.23
13. What value of c, if any, makes the following a probability density function?

$$f(x) = \begin{cases} c(1-x^2) & \text{if } 0 \le x \le 2 \\ 0 & \text{otherwise.} \end{cases}$$

14. I get *on average* 3 colds per year. A new drug, which is believed to be effective for 20% of the population, will halve the number of colds I get on average (if effective; it will do nothing otherwise). During the course of the year in which I take the drug, I get just one cold. How likely is it that I am among the 20% for whom the drug is effective?
15. Stenographer Jones makes on average 2.5 errors per page of court proceedings that he transcribes. Yesterday, he transcribed 60 pages of proceedings.
    (a) On average how many errors do I expect to see in total in the 60 pages?
    (b) On average, on how many pages will I expect to see 4 or more errors?
    (c) How likely is it that the fifth page I come to is the first with 4 or more errors?

(d) Errors cost money, so Jones has to pay the office pool 25c for every error he has made over the 60 pages. How much does he expect to pay, and what's the probability that he has to pay more than his expected value?

16. Assume that each time the New York Yankees play a baseball game, they have a probability .012 of having their pitcher throw a complete-game shutout, all games independent. During the course of a season, they play 162 games. Let X be the number of games in which their pitcher throws a complete-game shutout.

    (a) Calculate, to 4 decimal places, the *exact* probabilities of X taking each of the values 0, 1, 2, 3 and 4. (For this you will definitely want to use some kind of calculator, such as the ones linked to at the beginning of the list of problems).

    (b) Approximating X by a Poisson random variable, *estimate* to 4 decimal places the probabilities of X taking each of the values 0, 1, 2, 3 and 4.

    (c) Ponder on the two sets of answers. Do you like the Poisson as an approximation to the Binomial in this case?