Math 408, Spring 2008
HW Assignment 4, due Friday, 2/15/2008

Name (print please):

Instructions

- **Use this sheet as cover sheet and staple it to the assignment.** Write your name **legibly** in the space above; if necessary, underline your last name. If your name is not clearly and unambiguously identifiable on the class roster, we cannot credit you for the homework.
- Do the problems in order, and make sure that each problem is clearly labelled.
- Show all work; an answer alone will not earn credit.
- **Due date:** The assignment is due **in class** Friday this week; late homework, or homework dropped off in mailboxes, will not be accepted. You can, however, turn in the homework early, in my office, 241 Illini Hall, any time before the due date.
- **Open House Hours:** Wednesdays, 5 pm, 141 Altgeld. Backup slot: Thursdays, 5 pm, 141 Altgeld. I will stay as long as needed (typically till around 6 pm or 6:15 pm). The Open House is an informal office hour for students in my classes (Math 408 and 453). Feel free to stop by with questions about the homework or anything else relating to this course! Math 408 students should try to come to the Wednesday hour; on Thursday my Math 453 students will have priority, so use that slot only if you absolutely can't make it on Wednesday.

HW 4 Problems (from Hogg/Tanis, 7th edition)

1. 2.4-3
2. 2.4-4
3. 2.4-10
4. 2.4-13
5. 2.4-17
6. 2.4-18
7. 2.4-20
8. 2.5-4
9. 2.5-6
10. 2.5-7
11. 2.5-16(a)(b)
12. 2.5-22

***** Turn page for instructions and comments *****

Comments

- **General comments on success/failure type problems:**

  Nearly all problems in this set fall into the success/failure trials framework. In word problems, make sure to clearly state (i) what you interpret as a "trial", and (ii) what you interpret as a "success" *for a given trial*. For example, in a lottery problem, one might make the correspondence "trial $\leftrightarrow$ lottery ticket" and "success $\leftrightarrow$ winning ticket". Such an identification is not always obvious, but is crucial for obtaining the "right" probabilistic model for the given situation, and correctly computing the probabilities asked.

- **Probabilities relating to the *number of successes* in success/failure situations:**

  Most of the problems in 2.4 ask for probabilities of the type $P(X = x)$, $P(X \leq x)$, or $P(X \geq x)$, where X is the number of successes in a sequence of independent S/F trials. The distribution of such an X is the binomial distribution, $f(x) = P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$, $x = 0, 1, \ldots, n$, with appropriate parameters n and p. In working out probabilities like those above, use the method in class, which relied solely on the above (easily memorized) formula for $f(x)$. **In particular, do not use the distribution tables for the binomial distribution in the back of the book, as is done (quite superfluously) in Example 2.4-8 in the book. You won't be able to use such a table in actuarial exams nor in any exams/quizzes in this class, so you have to get used to get by without.**

- **Probabilities relating to the *occurrence of the first success* in success/failure situations:**

  Most problems in 2.5 boil down to finding probabilities of the type $P(X = x)$, $P(X \leq x)$, $P(X < x)$, $P(X \geq x)$, or $P(X > x)$, where X is the trial at the first success occurs. The distribution of such an X is the geometric distribution, given by $f(x) = P(X = x) = (1-p)^{x-1} p$ for $x = 1, 2, \ldots$. These problems are quite easy once you have correctly translated them into successs/failure language. The book does some of these problems via the negative binomial distribution, but this is serious overkill, and it makes an otherwise very easy problem look unduly complicated. All you need to know for the assigned problems is the geometric distribution given by the above formula; the negative binomial distribution was not covered in class and is not needed.

- **Problem 2.4-18.** This is a follow-up to the 2.4-17, and can be dealt with in much the same way.

- **Problem 2.4-20.** This is from an old actuarial exam. It's a two-stage problem. The first stage is a Bayes' type problem. The second stage is a success/failure type problem, much like 2.4-17(b) (the give-away word is "at least one in five"). It's easier than it looks once you break it down into these two stages. (Hint: The relevant events are A, B, C, with obvious interpretations ("batch is from factory A", etc.), and I, defined as "at least 1 in 5 vials is ineffective". If you have questions, come to Wednesday's Open House!)