Math 408, Spring 2008
HW Assignment 9, due Friday, 4/4/2008

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** on Friday. 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. 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.

Problems (from Hogg/Tanis, 7th edition)

1. 4.1-5
2. 4.1-8
3. 4.1-9
4. 4.1-10
5. 4.1-11
6. 4.1-12
7. 4.2-10 (omit (c))
8. 4.2-11 (omit (c))
9. 4.2-12 (omit (c))

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

Instructions/comments on the problems in HW 9

The problems in this set involve joint continuous distributions. Most problems (or subproblems) break down into two distinct parts. The first consists in applying appropriate definitions and formulas to express the probability, expectation, covariance, etc. requested as a double integral. This requires knowing these definitions and formulas; they can be found on the multivariate distribution handout, but you should get to a point where you have those formulas memorized, since in exams and quizzes you are on your own and won't be able to refer to the handouts. The second, and usually more difficult, part consists in evaluating the double integrals arising in the process.

Below are some tips that help avoid mistakes. For additional tips, especially on double integrals, see the multivariate distribution handout.

- **Keep track of ranges:** When writing down a density (p.d.f.), always write down its range (domain) in terms of inequalities on x and/or y. Do this both for ordinary one-variable densities (including marginal densities and conditional densities), and for two-variable joint densities. This helps avoid mistakes down the road, and is necessary to get the limits in integrals right. A range is essential for a complete specification of a density.

- **Sketch!** Arguably the most important piece of advice. For double integrals, sketch the region of integration. For any joint (continuous) p.d.f. $f(x, y)$, sketch its "range", as a region in the xy-plane. If a problem asks for a probability such as $P(X + Y \leq 1)$, sketch the part of the range that corresponds to the underlying event.

- **Perform some basic sanity checks.** Ask yourself if the answer makes sense. For example: If you have to find a probability, the answer had better be a number between 0 and 1. If you have to find a marginal density, the function obtained has to be nonnegative, and the integral over the full range has to be 1.

- **4.1-5 and 4.1-12:** Both of these problems are old actuarial exam problems and involve a joint density that is uniform over a certain region. Thus, probabilities can be computed geometrically as ratios of areas, requiring nothing more than high school level trigonometry. The first problem is of the same type as an example worked out in class on Friday (the probability that two random numbers from the interval $[0, 1]$ differ in absolute value by at most 0.5). The second problem involves more complicated triangular regions; here a *very careful* sketch of the relevant regions is essential.