ECE 5510 Fall 2009: Homework 5

Due: at 5pm in the homework locker, Tuesday, October 20

1. Y&G 4.1.1

2. Y&G 4.2.2. Don't do anything fancy - just tabulate all of the values of $P_{X,Y}(x, y)$.

3. Y&G 4.2.4. Again, tabulate the joint pmf.

4. Y&G 4.4.2. Hint: For the min, either X or Y must be less than the value. For the max, both X and Y must be less than the value.

5. Y&G 4.7.3

6. **Probability of Real Roots of a Quadratic Equation**: You pick two real numbers A_1 and A_2 independently, both chosen to be uniform continuous random variables on $[-n, n]$. Assume that n is a real number and $n > 4$.

   (a) Draw a 2-D graph, with axes A_1 and A_2, shading the area for which the equation

   $$t^2 + A_1 t + A_2 = 0 \tag{1}$$

   has real roots for t when A_1 and A_2 are both in $[-n, n]$. Hint: the quadratic formula says that

   $$t = \frac{-A_1 \pm \sqrt{A_1^2 - 4A_2}}{2}. \tag{2}$$

   thus t is real if the expression in the square root in (2) is positive.

   (b) Compute the probability that (1) has real roots.

   (c) Show that as $n \to \infty$, that the probability from (b) approaches 1. (This problem is a proof that "almost all" quadratics have real roots if the coefficients are chosen from a uniform distribution.)