**Problem 1) Coupon Collecting** A cereal company is running a promotion where each cereal box contains a coupon. There are n different types of coupons, and each box contains one randomly chosen coupon with equal probability. What is the expected number of boxes you need to buy to collect all n types of coupons?

**Problem 2) Broken Stick** You have a stick of unit length. You break it into two places at random along its length, forming three smaller sticks. What is the probability that these three sticks can form a triangle?

**Problem 3) Order of iid** Let  $X_1, X_2, X_3, X_4$  be i.i.d. exponentially distributed random variables. Find  $\Pr(X_1 \le X_2 \le X_3 \le X_4)$ 

**Problem 4)** The Robot Weightlifting World Championship's final round is about to begin! Two robots, seeded 1, and 2 remain in contention. They take turns from the 2nd seed to the 1st seed, publicly declaring exactly how much weight (any nonnegative real number) they will attempt to lift, and no robot can choose the same amount as a previous robot. Once the two weights have been announced, the robots attempt their lifts, and the robot that successfully lifts the most weight is the winner. If all robots fail, they just repeat the same lift amounts until at least one succeeds. Assume the following:

- 1. all the robots have the same probability p(w) of successfully lifting a given weight w;
- 2. p(w) is exactly known by all competitors, continuous, strictly decreasing as the w increases, p(0) = 1, and  $p(w) \to 0$  as  $w \to \infty$ ; and
- 3. all competitors want to maximize their chance of winning the RWWC. If w is the weight the 2nd seed should request, find p(w). Give your answer to an accuracy of six decimal places.