EECS 70 Discrete Mathematics and Probability Theory
Fall 2014 Anant Sahai

Discussion 11W-S

1. Balls and Bins. Suppose you have m labeled balls $a_1, \ldots, a_m$ that you have thrown one by one, uniformly at random into n labeled bins $b_1, \ldots, b_n$. For each of the probabilities below, select all answers that apply from the list of choices.

1. What is the probability that b_j contains a_i? When a_i is being thrown, what is the probability that it lands in b_j? How many choices are there?

2. What is the probability that b_j is empty? For each ball, what is the probability that it does not end up in b_j? Are these events independent?

3. What is the probability that b_j contains all of the balls? For each ball, what is the probability that it ends up in b_j? Are these events independent?

4. What is the probability that b_j contains exactly k balls? For each ball, what is the probability that it ends up in b_j? Are these events independent? Does order matter?

5. What is the probability that b_j contains at most k balls? What is the probability that b_j contains exactly i balls?

2. **Processes, servers and overloading.** I have M processes (jobs) and N servers that I can assign the jobs to. Any job may be assigned to any server. Suppose I assign each job to a randomly chosen server, with all servers being equally likely. We say that a server is overloaded if it is assigned greater than or equal to K jobs, where $K \leq M$. What is the probability that the first server is overloaded?