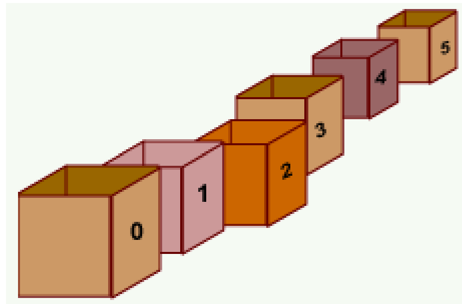
**CS 7A - Spring 2016 - Computer Simulation of "Give Me a Chance". Due 5/19/16**




Computer simulation is the practice of designing a model of an actual or theoretical physical system or process, executing the model on a digital computer, and analyzing the execution output. Simulation embodies the principle of "learning by doing" — to learn about the system we must first build a model of some sort and then operate the model. The use of simulation is an activity that is as natural as a child who role plays. Children understand the world around them by simulating (with toys and figurines) most of their interactions with other people, animals and objects. As adults, we lose some of this childlike behavior but recapture it later on through computer simulation. To help understand reality and all of its complexity, we can build artificial objects and dynamically act out roles with them. Computer simulation is the electronic equivalent of this type of role playing and it serves to drive synthetic environments and virtual worlds. Within the overall task of simulation, there are three primary sub-fields: model design, model execution and model analysis.

In this project we will simulate a process in order to solve problems like this one, called "Give Me a Chance":

> ***There are 100 boxes assigned to 100 students who are lined up to collect them. The first two students each take a random box, but every other student takes their assigned box if available and a random box otherwise. What is the probability that the last student will take her assigned box?***

To solve this problem (and generalize its solution) we might start by building a `class` called `Distribution` with data members `number_boxes`, `number_random` and a `vector<bool> taken(number_boxes)` which will be all zeros initially, indicating that none of the boxes are taken at the start. Since the simulation of the distribution of boxes will need to be done repeatedly, it'd be helpful to have a `reset_boxes()` member function that will execute the command `fill(taken.begin(), taken.end(), 0)`, thereby resetting all the boxes to zero after a simulation is finished.

The idea is then to run, say, 1,000,000 simulations of the process of having `number_random` boxes initially randomly distributed to the first `number_random` students and then the remaining students picking their box if it's still available, or a random remaining box if their box has been taken. Count how many of these simulations leave the last student with her own box and then approximate the probability that she receives her box as this count divided by 1,000,000.

Analyze your results in terms of how the probability is dependent on `number_boxes` and `number_random`.