



## Multi-Colored Dice

**STEM Sims**

### Lesson 4: The Pigeonhole Principle

The Pigeonhole Principle states that if you have  $X$  pigeonholes and  $X + 1$  (or more) pigeons, then one pigeonhole must contain more than one pigeon. Sounds simple enough...are you ready to try some more problems? The solutions to the following problems require very little mathematics – but you do have to think a little.

#### Do You Understand?

1. Pick a book at random from the library. Pick a random sample of 27 pages in the book. Make a listing of the first English word on each page. At least two of the words will begin with same letter.
2. At every NFL football game in 2012 there will be at least two people who have the same *three* initials (First Name, Last Name, and Middle Name)
3. At every 2012 Dallas Cowboys' home game there are at least 200 people who have the same birthday.
4. If you pick five numbers from the integers 1 to 8, then two of them must add up to nine.
5. At the United States Military Academy there are about 4500 undergraduate students that are Americans. There is at least one student from each of the 50 states. Show that there must be a group of at least 90 coming from the same state.
6. In a group of 8 people show that at least two of them were born on the same day of the week.
7. Thirty (30) students took a 50 question multiple-choice exam. The student who missed the most questions had 12 questions wrong. The rest of the class had fewer errors. Show that at least 3 students missed the same number of questions.
8. Most people have more than five friends on Facebook but let's keep this problem simple. Show that in any group of five people, there are two who have the same number of friends within the group. (Assume that friendship is commutative – if A is a friend of B then B is a friend of A.)