Last name _____

First name _____

LARSON—MATH 350—CLASSROOM WORKSHEET 11
Pigeonhole Principle.

Review

- How does proof by *mathematical induction* work?

- Let $P(n)$ be the statement that the formula is true for the first n even integers. $P(1)$ is clearly true. You showed $P(2)$, $P(3)$, $P(4)$ and $P(5)$ are true. Assume $P(k)$, that this property holds for the first k even integers. Write $P(k)$.

- Assume $P(k)$ is true. Argue that it then follows that $P(k+1)$ is also true. Conclude that $P(n)$ is true for all integers $n \geq 1$.

Inclusion-Exclusion (Sec. 2.3)

1. Determine the number of numbers in $[100] = \{1\dots100\}$ that are divisible by either 2, 3 or 5.

Pigeonhole Principle (Sec. 2.4)

2. If a dozen pigeons fly into 10 pigeonholes, what can you conclude?

Assume the set of outcomes $S = \{s_1, s_2, \dots, s_n\}$ of an *experiment* are *equally likely*, then the probability of an *event* $E \subseteq S$ is:

$$\frac{|E|}{|S|}$$

3. You roll a six-sided die with the numbers 1,2,3,4,5,6 on the faces. Find the probability of rolling a 2.

4. Find the probability of *not* rolling a 2.

Birthday Problem

5. There are 365 days in the year. Find the number of different possibilities (day and month) for the birthdays of 2 people.

6. Find the number of different possibilities for the birthdays of 20 people.

7. Find the number of different possibilities for the birthdays of n people.

8. Find the number of ways that 2 people can have different birthdays.

9. Find the number of ways that 20 people can have different birthdays.

10. Find the number of ways that n people can have different birthdays.

11. Find the probability that 2 people have different birthdays.

12. Find the probability that 20 people have all different birthdays.

13. Find the probability that n people have all different birthdays.

14. Find the probability that 2 people have the *same* birthday.

15. Find the probability that at least one pair among 20 people have the *same* birthday.

16. Find the probability that at least one pair among n people have the *same* birthday.