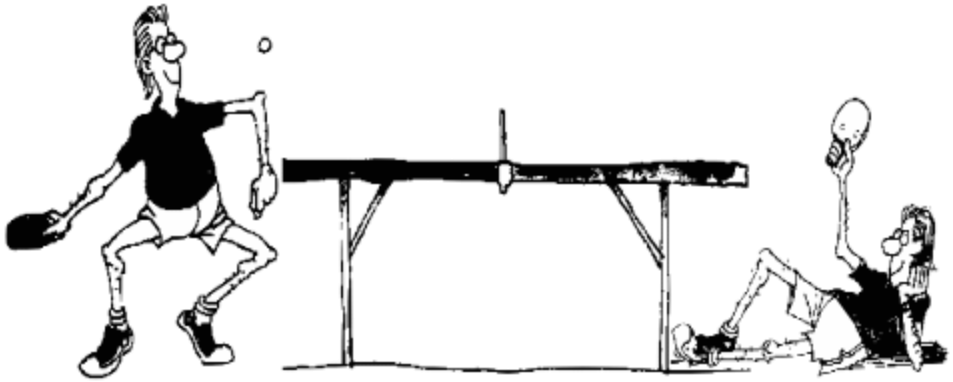
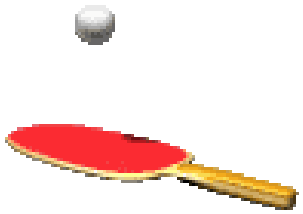
Question of the Day

- How many Ping-Pong balls are needed to fill up the classroom?





2.1 COUNTING

How the Pigeonhole Principle Leads to Precision Through Estimation

© tuja66/iStockphoto

The simple modes of number are of all other the most distinct; even the least variation, which is a unit, making each combination as clearly different from that which approacheth nearest to it, as the most remote; two being as distinct from one, as two hundred; and the idea of two as distinct from the idea of three, as the magnitude of the whole earth is from that of a mite.

JOHN LOCKE

Question of the Day

- How many ~~Ping-Pong balls~~ Basketballs are needed to fill up the classroom?

- **How many ping-pong balls can you fit into a Ford Escape?** *(Thursday, July 19, 2012)*

- How about 56,778? That's the ping-pong ball count you'll need to fill up a Ford Escape. Ford knows this because the company uses ping-pong balls to measure odd-shaped spaces like console compartments and glove boxes in its vehicles.

- According to Ford engineers, this method more effectively measures the volume of interior storage spaces than by using a measuring tape. Often, two people who measure the same console with a measuring tape come up with quite different figures. But by using ping-pong balls, the two will get similar results.

- The engineers developed a cubic measurement for each ping-pong ball that accounts for the open space between a stack of balls. They then use that measurement and the number of ping-pong balls in a particular storage space to determine the total volume.

http://wot.motortrend.com/2013-ford-escape-interior-spaces-measured-with-pingpong-balls-235287.html#axzz2dNjabb7F

Quantitative Estimation

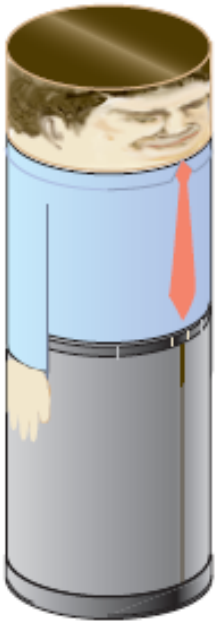
- One powerful technique for increasing our understanding of the world is to move from **qualitative** thinking to **quantitative** thinking whenever possible.
- **qualitative –**
- **quantitative –**
- **What are examples of items that can be counted but are hard to quantify?**

The Hairy Body Question

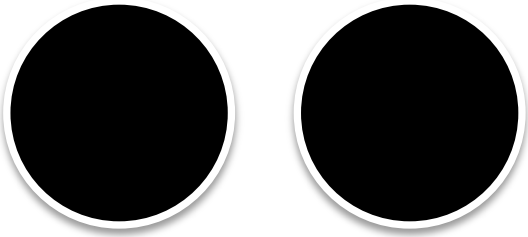
- "It would be difficult, awkward, and frankly just plain weird to count the number of hairs on your roommate's body. Without undertaking the perverse task, we nevertheless pose the following."

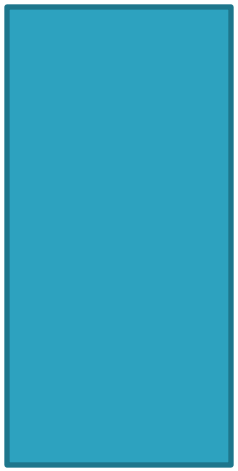
Does there exist two non-bald people on the planet who have *exactly the same* number of hairs on their body?

How Hairy Are We?



How Hairy Are We?





How Hairy Are We?

How Many Are We?

- http://www.census.gov/main/www/popclock.html
- There are more than 7 billion (7,000,000,000) people on this planet.
- So, does there exist two non-bald people on the planet who have ***exactly the same*** number of hairs on their body?

Pigeonhole Principle

- What is the pigeonhole principle?
- Imagine that 10 pigeons need to be placed into 9 pigeonholes. Can it be done?

- The answer is yes, but there is one catch.
- The catch is that no matter how the pigeons are placed, one of the pigeonholes must contain more than one pigeon.

Pigeonhole Principle

- Suppose we have five closed tennis-ball cans of standard size (each can holds up to three balls). How can we show for certain—without looking in the cans—that two cans contain the same number of balls?

Homework

- Read 2.1 Counting – pages 44-52.
- State the Pigeonhole Principle in your own words.
- Provide and explain at least one example of the application of the Pigeonhole principle and at least one example of quantification in everyday life.
- Mindscapes 2.1 #1, 4, 8, 11, 15, 19
- A Million Things