1. (Mindscape 8, §3.1 of text) Here are two collections of the symbols % and &:

% % % % % % % % % % % % % %
& & & & & & & & & & & & & &

Are there more %'s than &'s? Describe how you can quickly answer the question without actually counting, and explain the connection with the notion of one-to-one correspondence.

2. (Mindscape 21, §3.1 of text) Suppose you have a finite number of pigeons and a finite number of holes. You try a method of assigning pigeons to holes and, after filling all the holes (one pigeon per hole) some pigeons remain. If you remove the pigeons and try again, is there any hope of placing each pigeon in an individual hole the second time? Suppose instead you have an *infinite* number of pigeons and holes. Is it now possible that a first attempt to give each pigeon an individual hole fails but a second attempt succeeds?

3. **Hand in this question with Assignment 3:** (Mindscape 30, §3.2 of text) Double Decker is a kind of chocolate bar. Each Double Decker package contains two delicious chocolate pieces. Suppose you had infinitely many Double Decker bars — one for each natural number. Does the collection of individual chocolate pieces have the same cardinality as the set of all natural numbers? If not, explain why? If so, provide a one-to-one correspondence.

4. (Mindscape 32, §3.2 of text) Not-Finite City is made up of infinitely many roads running north and south (one road for each natural number) and infinitely many streets running east and west (one street for each natural number). A traffic light is placed at every intersection of a street with a road. How many traffic lights are there? Does the set of traffic lights have the same cardinality as the set of natural numbers? If not, explain why. If so, provide a one-to-one correspondence.

5. Your friend gives you a list of three, five-digit numbers, but she only reveals one digit in each: 3????, ?8???, ??2??. Can you describe a five-digit number you know for certain will not be on her list? If so, give one; if not, explain why not.

6. Consider again the Ping Pong Ball Conundrum discussed in class, together with the following variations:

(a) In each step you add 10 balls as before but you remove ball No. 2 in Step 1, ball No. 4 in Step 2, ball No. 6 in Step 3, and, more generally, ball No. $2n$ in Step n.

(b) The barrel begins with infinitely many balls, numbered 1,2,3,.... No balls are added but ball No. n is removed at Step n (for every natural number n).

(c) In each step you add 10 balls but then remove a *randomly* selected ball.

Decide how many balls are left in the barrel at the end of the experiment and discuss with your group and tutor.