M314 REVIEW EXERCISES 25.01.17

You're encouraged to discuss these problems with other students in the class.

Dictionary:
A set S with elements -1, 0, 1 can be written as: $S = \{-1, 0, 1\}$
$0 \in S$ "0 belongs to S"
$2 \notin S$ "2 does not belong to S"
$\mathbb{N} \subseteq \mathbb{Z}$ "The set of natural numbers is a subset of the set of integers."
$\emptyset$ is the "empty set," a set with no elements.
If we're talking about operations on sets A and B we usually have a "universal set" or "universe set" - a big set that both A and B are subsets of.
$A \cap B$ is the intersetion of A and B, all elements x such x is in both sets.
$A \cup B$ is the union of A and B, all elements x such x is in at least on of the sets.
A^C is the complement of A, all elements of the universe set that are not in A.
$A - B$ is the set difference of A and B. All elements of A that are not in B. Notice this one is not symmetric.

1. Write down the size of each of the sets displayed on the screen.

2. Shade in the Venn Diagram as appropriate.
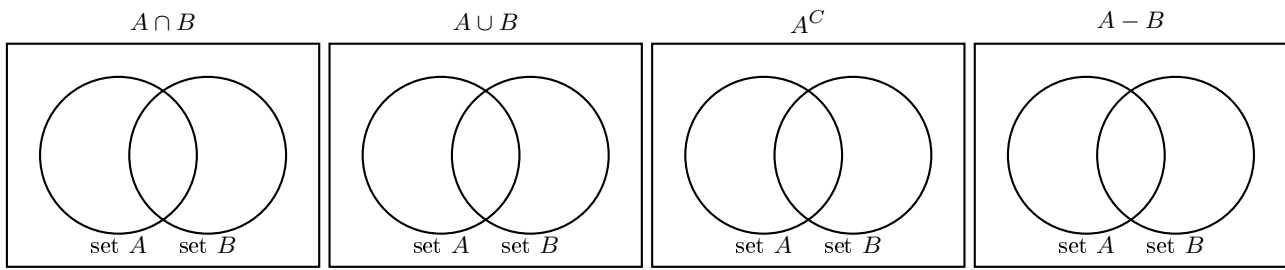
3. For a universal set U, and sets A and B in U, complete the following:
   a) $A \cup U =$
   b) $A \cap \emptyset =$
   c) $(A^C)^C =$
   d) $(A \cup B)^C = A^C \_\_ B^C$
   e) $(A \cap B)^C = A^C \_\_ B^C$
   f) $U^C =$
   g) $\emptyset^C =$
   h) $A \cup A^C =$
   i) $A \cap A^C =$

4. Let:
$$A = \{0, 1, 2, 3\}, \quad B = \{1, 3, 314\}, \quad C = \{-1, 1\}$$

   Find the following sets.
   – $A \cap B \cap C =$

   – $(A \cap B) - C =$

   – $A \cap (B - C) =$

   Write out the power set of B. How many elements does it have?

   Find a partition of A into two mutually disjoint, non-empty sets.

5. Explain how you would use the pigeonhole principle to prove the following: You have 70 cookies, that you can eat over a period of 44 days. If you eat at least one cookie per day, show that there is a period of consecutive days, during which you will eat exactly 17 cookies.