Set Theory: Review

You should be familiar with the following set theory concepts and the related notation.

- Natural numbers (counting numbers): $\mathbb{N} = \{1, 2, 3, \ldots\}$
- Integers: $\mathbb{Z} = \{\ldots, -2, -1, 0, 1, 2, \ldots\}$
- Whole numbers: $\{0, 1, 2, 3, \ldots\}$
- Real numbers:$\mathbb{R} = \{x \mid x \text{ can be written as a decimal}\}$
- Rational numbers$\mathbb{Q} = \{\frac{a}{b} \mid a, b \in \mathbb{Z}\}$
- Irrational numbers: Real numbers that cannot be written as a quotient of integers.
- A set A is a subset of a set B, $A \subseteq B$, if every element of A is also an element of B.
- A is a proper subset of B, $A \subset B$, if $A \subseteq B$ and $A \neq B$.

Note: The only non-proper subset of A is A.

- The complement of a set A, written A', is the set of all elements in the universe that are not in A.

$$A' = \{x \mid x \in U, x \notin A\}$$

- The number of subsets of a set with n elements is 2^n. There are $2^n - 1$ subsets.
- The difference between two sets, $A - B$, is the set of the elements in A that are not contained in B.

$$A - B = A \cap B' = \{a \mid a \in A, a \notin B\}$$

- The intersection of two sets, $A \cap B$, is the set of elements in both A and B.

$$A \cap B = \{x \mid x \in A, x \in B\}$$

- The union of two sets, $A \cup B$, is the set of elements in A or B (, or both).

$$\{x \mid x \in A \text{ or } x \in B\}$$

- An ordered pair is a pair of two elements such that the order matters, $(a, b) \neq (b, a)$, in general.
- The Cartesian product of two sets: $A \times B = \{(a, b) \mid a \in A, b \in B\}$
- DeMorgans Law: $(A \cap B)' = A' \cup B'$ and $(A \cup B)' = A' \cap B'$
- Cardinal number formula: $n(A \cup B) = n(A) + n(B) - n(A \cap B)$