Some set theoretical notation for CFR540

- Say we have a **set** of four numbers: 1,2,3,4. Let *A* denote this set. We say $A = \{1, 2, 3, 4\}$.
- The four numbers are the **elements** of set *A*. We say for example that $1 \in A$ (number 1 is an element of set *A*. Number 1 could of course be an element of other sets too.
- We can index the elements of a set. Say *i* indexes set *A*. We can say that $i \in A$. We can also say things like $i \geq 0 \quad \forall i \in A$. In other words, each element of set *A* is greater than or equal to zero. The sign $\forall$ means "for any" or equivalently: "for all".
- The **cardinality** of a set is equal to the number of elements in the set: $|A| = 4$

- Suppose we have another set: $B = \{4, 5, 1, 7, 8\}$. The **union** of set *A* and *B* is denoted by $A \bigcup B = \{1, 2, 3, 4, 5, 7, 8\}$.
- The **intersection** of A and B: $A \bigcap B = \{1, 4\}$.
- The **complement set** is the set of elements in one set that are not members of another set. For example $B \setminus \{A \bigcap B\} = \{5, 7, 8\}$. We also call this as **set difference**.
- If all the members of a set, say set C are also elements of another set, say set *D*, then say that set *C* is a **subset** of set *D*: $C \subseteq D$. Conversely, set *D* is a **superset** of set *C*: $D \supseteq C$.
- All possible subsets of a set is called a **power set**. For example, the power set of set *A* has 16 elements: $\left\{\{\,\}, \{1\}, \{2\}, \{3\}, \{4\}, \{1, 2\}, \{1, 3\}, \{1, 4\}, \{2, 3\}, \{2, 4\}, \{3, 4\}, \{1, 2, 3\}, \{1, 2, 4\}, \{1, 3, 4\}, \{2, 3, 4\}, \{1, 2, 3, 4\}\right\}$

- Set $\{\,\}$ is called the **empty set** and is also denoted by $\varnothing$.

- Some of the numbers that we will deal with are binary in nature. They are either 0 or one (true or false, yes or no). In other words, they are elements of the binary set: $\mathbb{B} = \{0,1\}$. We will also deal with integer numbers, set $\mathbb{Z}$, and rational numbers set $\mathbb{Q}$.