Discussion Points, Class of Sept 14

1. Discuss Part 1 of Project 3
2. Use a 'Decision tree' to list the 8 possible subsets of a set $A = \{a_1, a_2, a_3\}$ with 3 elements. This generalizes to:
   Fact: If $|A| = n$ then $|\mathcal{P}(A)| = 2^n$
3. Union and intersection are associative operations:
   $$(A \cup B) \cup C = A \cup B \cup C = A \cup (B \cup C)$$
   $$(A \cap B) \cap C = A \cap B \cap C = A \cap (B \cap C)$$
4. If $A_1, A_2, \ldots, A_n$ are sets then
   $$A_1 \cup A_2 \cup \cdots \cup A_n = \{x \mid x \in A_i \text{ for some } 1 \le i \le n\}$$
   $$A_1 \cap A_2 \cap \cdots \cap A_n = \{x \mid x \in A_i \text{ for all } 1 \le i \le n\}$$
5. $(A \cup B) \cap C = A \cup (B \cap C)$ is not a law of set theory. This means that $(A \cup B) \cap C$ and $A \cup (B \cap C)$ are not equal for all sets A, B and C. However they may be equal for some A, B and C.
   Use Venn diagrams to see this.
6. The Venn diagram picture suggests a true statement: "If A, B, C are sets with $A \subseteq C$ then $(A \cup B) \cap C = A \cup (B \cap C)$."
7. Venn diagrams for 5 and 6: