

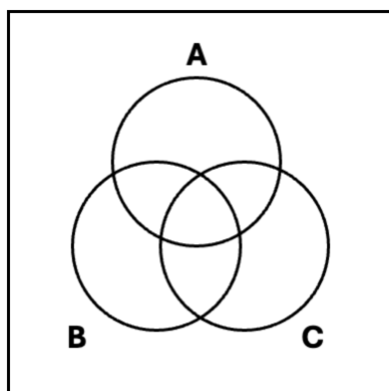
Formal Languages and Automata Theory
Homework 1

Find a simpler expression for each of the following (problems 1 and 2):

1. $\overline{(A \cup B)} \cup B$

2. $\overline{(A \cap \overline{B})} \cap B$ (there is a bar over the B and over the first intersection)

3. Redraw the Venn diagram below shading the regions to represent $(B \cup C) \cap \overline{A}$ (or shade in the regions in the diagram)



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4. Let $A = \{a, c, e\}$. What is the power set of A ?
5. Let A be as above and B be $\{3, 5, 7\}$. What is $A \times B$? What is $B \times A$? What is $A \times A$?
6. Consider the following relations on the set of all television shows on broadcast networks ABC, CBS, NBC, and Fox. Make the simplifying assumption that each show appears weekly in the same time spot on only one of the networks listed. Assume further that each show runs for a half hour, one hour, or two hours and that shows start on the hour or half hour. State whether each relation is reflexive, symmetric, or transitive.
- a. $R_T = \{(i, j) \mid \text{show } i \text{ and show } j \text{ start at the same time}\}$
- b. $R_N = \{(i, j) \mid \text{the broadcast of show } i \text{ overlaps the broadcast of show } j\}$
- c. $R_L = \{(i, j) \mid \text{show } i \text{ has the same length as show } j\}$

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7. Let B be the set of all strings of 0s and 1s (that is, binary strings) of length 3 or 4. Consider the following equivalence relation on B : $R = \{(w,x) \mid w \text{ and } x \text{ begin with the same bit and end with the same bit}\}$; for example 100 and 1010 are related using R and are in the same equivalence class, because they both begin with 1 and end with 0.

List the members of each equivalence class of B imposed by R .

8. Let C be the set of all positive integers less than 15. Let R be the equivalence relation defined as follows: $R = \{(x,y) \mid x \bmod 4 = y \bmod 4\}$.

List the members of each equivalence class of C imposed by R .