CSI 30 LECTURE NOTES (Ojakian)

Topic 6: Set Operations

OUTLINE
(References: 2.1, 2.2)

1. Set Operations
2. Proofs about sets

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1. Set Operations
   (a) From one or more sets, we construct a new set
   (b) For each we have 1) intuitive description, 2) notation, 3) Propositional logic description , and 4) Venn diagram picture.
2. Set Product
   (a) Connection to usual multiplication?
   (b) Does $A \times B = B \times A$?
   (c) Count the number of elements.
   (d) Picture it (not Venn): Make a grid.
3. Set Union
   (a) Connection to OR
   (b) Do in Python
4. Set Intersection
   (a) Connection to AND
   (b) Do in Python
5. Set Difference
   (a) Connection to subtraction
   (b) Do in Python
6. Set Complement
   (a) Start with just one set
   (b) Need stated universal set.
7. Power Set
   (a) Start with just one set

8. Putting Them Together

   (a) Exercise: Consider why some of the set identites in Section 2.2.2 (page 136) are true?

   (b) Do some examples in Python of their truth

   (c) Intuitive justifications via Venn Diagrams

      i. Example: Pick a set identity from Table 1 (Section 2.2, page 136)

9. Proofs about sets

   Note: Will only accept the following 2 approaches (in particular: "membership table" approach NOT accepted).

   (a) Proof Approach One: Directly from definition and propositional logic

      i. Example: Prove that if $A \subseteq B$ and $B \subseteq C$, then $A \subseteq C$.

      ii. Example 10 (half): Prove that $\overline{A \cap B} \subseteq \overline{A} \cup \overline{B}$

   (b) Proof Approach Two: Use established Set Identity Lemmas.

      i. Example 14. Using laws

10. More exercises

   (a) Set Operations. Section 2.2: 2 - 4, 27

   (b) Venn Diagrams. Section 2.2: 28 - 30

   (c) Products. Section 2.1: 29, 32, 37, 38

   (d) Power Set. Section 2.1: 23, 24, 26

   (e) Proofs.
   Section 2.1: 19, 27, 28, 33, 40, 43, 44
   Section 2.2: 5 - 13, 15 - 17, 19 - 26, 35 - 37

   (f) Interesting. Section 2.2: 31 - 34