CS 145 – Foundations of Computer Science

Professor Eric Aaron

Lecture – T R 3:10pm
Lab – M 3:10pm

Lecture Meeting Location: OH 162
Lab Meeting Location: SP 309

Business

• Change lecture rooms for first half of the semester?

• HW1 due Tuesday, February 13
  – (i.e., at the beginning of class that day—as always, please see the HW sheet for information about HW deadlines)

• See links from course webpage Additional Notes / Readings for two documents:
  – A document about induction (containing the proof from the last lecture!)
  – A document about the equational proof style we use for inductions

• Reading: Please finish Ch. 1 from your textbook
  – Your book talks about sets and diagrams in Ch.1.2.3; it’s interesting, but I won’t cover it in class
Defining Sets

• Intuitively, there are multiple ways of defining a set
  – Enumerate all of its individual members
    • E.g., \{2, 3, 5, 7\}, \{1, 2, 3, 5, 8, 13\}
  – Provide a common, defining property
    • E.g., \{n \mid n \text{ is a prime number less than 10}\},
      \{n \mid n \text{ is a Fibonacci number less than 20}\}
  – Either of these is fine, as long as the definition is complete
    and clear in context

(There are other ways, too, but we’ll focus on these for now)

Intersection

• There are some fundamental set operations, i.e., ways of constructing sets
  from other sets
• Example: Intersection
  – Intuitively, an intersection is what two (or more) things have in common
  – For sets A, B, the intersection A ∩ B is the set of elements that A and B have in
    common. More formally…
• Definition: The intersection A ∩ B of sets A and B is defined by:
  \( x \in A \cap B \iff x \in A \text{ and } x \in B \)
  – Also written as \( A \cap B = \{ x \mid x \in A \text{ and } x \in B \} \)
• Examples:
  – What’s \( \{1,2,3,4\} \cap \{2,4,6,8\} \)?
  – What’s \( \{ x \mid x \text{ is odd between 0 and 10} \} \cap \{ x \mid x \text{ is prime between 0 and 10} \} \)
Union

• Another set operation: Union
  – Intuitively, a union is the combination of what two (or more) things have when they’re put together
  – For sets A, B, the union A ∪ B is the set of elements that either A or B contain. (Or both! This is a non-exclusive or.) More formally…
• Definition: The union A ∪ B of sets A and B is defined by: x ∈ A ∪ B iff x ∈ A or x ∈ B
  – Also written as A ∪ B = \{x | x ∈ A or x ∈ B\}
• Examples:
  – What’s \{1,2,3,4\} ∪ \{2,4,6,8\}?
  – What’s \{x | x is odd between 0 and 10\} ∪ \{x | x is prime between 0 and 10\}

Definitions like the definition of union or of intersection can be important parts of proofs—they can be reasons for proof steps. In your proofs, think about what definitions can be used to justify your proof steps!