Review: P, NP, NPC

Review: P and NP

- What do we mean when we say a problem is in P?
  - Answer: It means there is an algorithm that solves the problem in polynomial time.
- What do we mean when we say a problem is in NP?
  - Answer: There is a solution to the problem whose correctness can be verified in polynomial time.
- What is the relation between P and NP?
  - Answer: $P \subseteq NP$, but it is still unknown whether P = NP

Review: NP-Complete

- What, intuitively, does it mean to say that we can reduce problem Q to problem R?
  - Answer: Q is "no harder than" R or R is "at least as hard as" Q
- What does it mean to say that Q is polynomial reducible to R?
  - Answer: Q is polynomial reducible to R if, in polynomial time, you can transform any solvable instance of type Q into a solvable one of type R so that a solution to one yields a solution to the other.
- What does it mean to say that Q is NP-Hard?
  - Answer: Every problem A in NP can be polynomial-reduced to Q .
- What does it mean to say that Q is NP-Complete?
  - Answer: Q is in NP and Q is NP-Hard.

True/False

- If Problem A is polynomial reducible to B and A is in NP, then B is in NPH.
  - Answer: False. For B to be in NPH, it must be true that every NP problem is polynomial reducible to B.
- If Problem A is polynomial reducible to Problem B, then B is polynomial reducible to A.
  - Answer: False.

True/False

- If someone can find a polynomial time algorithm to solve one of the NP-Complete problems, then all NP-complete problems can be solved in polynomial time.
  - Answer: True.
- Suppose A is an NP-complete problem and A is polynomial reducible to B. Then B is also NP-complete.
  - Answer: False. We can only conclude B is NP-hard. (B may not be in NP.)