Solution to Homework Problem 23

Homework Problem 23. What is NP? What is P? What is NP-complete? What is NP-hard? Give brief definitions. Give an example of an NP-complete problem. Is P equal to NP?

Solution.

- P is the class of all the problems that can be solved in polynomial (= feasible) time.
- NP is the class of all the problems for which, once you have a candidate for a solution, you can check, in polynomial time, where this candidate is indeed a solution.
- A problem from the class NP is called NP-complete if every problem from the class NP can be feasibly reduced to this problem.
- A problem is called NP-hard if every problem from the class NP can be feasibly reduced to this problem. *Comment:* the difference from NP-completeness is that an NP-hard problem may not be from the class NP.
- Example of an NP-complete problem – propositional satisfiability:
  - *given:* a propositional formula, i.e., any expression obtained from Boolean variables by using "and", "or", and "not",
  - *find:* the values of the Boolean variables that make the given formula true.
- Is P equal to NP? It is an unsolved open problem. Most computer scientists believe that P is different from NP.