Solution to Homework Problem 22

**Homework Problem 22.** 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 reduced to this problem.

- A problem is called NP-hard if every problem from the class NP can be reduced to this problem. *Comment:* the difference from NP-complete 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.