Homework 4
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Although you have several weeks to complete this assignment, please start thinking about these problems immediately, and work in study groups. Please prove all your answers; informal arguments are acceptable, but please make them precise/detailed enough so that they can be easily made rigorous.

In questions 1-5 Solve the following problems from [Sipser, Second Edition]:

2. Pages 182-184: 4.2, 4.3, 4.4, 4.6, 4.7, 4.10, 4.12, 4.15, 4.18, 4.19, 4.27, 4.28.
3. Pages 211-214: 5.9, 5.12, 5.13, 5.14, 5.15, 5.16, 5.20, 5.27, 5.33, 5.35.
4. Pages 294-300: 7.1, 7.2, 7.6, 7.7, 7.9, 7.11, 7.17, 7.21, 7.26, 7.32, 7.36, 7.42.
5. Pages 329-332: 8.4, 8.11, 8.17, 8.22.
6. True or false: for any compression scheme and any integer N, there exists some string of N bits that can not be compressed by even a single bit.
7. Two space aliens walk into your home, both claiming to be oracles for the satisfiability problem (SAT). They both reply in constant time for any instance(!), and are each self-consistent (i.e. each always gives the same answer for the same instance). However, you suspect that one is a true oracle and the other is a shameless impostor, and you have an instance of SAT upon which they disagree. Can you expose the impostor within time polynomial in the size of that instance?
8. Write a C program that prints itself out (without reading files/keyboard, etc.).
9. Is matrix multiplication NP-complete?