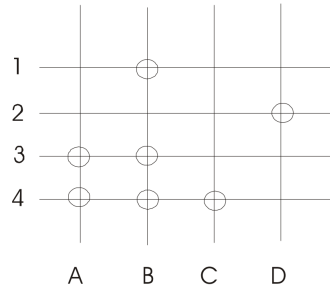


CS 341 Automata Theory
Elaine Rich
Homework 13
Due: Tuesday, April 17

This assignment covers Sections 21.1 - 21.3

- 1) In Appendix E.3, we describe a straightforward use of reduction that solves a grid coloring problem by reducing it to a graph problem. Given the grid G shown here:



- a) Show the graph that corresponds to G .
- b) Use the graph algorithm we describe to find a coloring of G .
- 2) In this problem, we consider the relationship between H and a very simple language $\{a\}$.
- a) Show that $\{a\}$ is *mapping* reducible to H .
- b) Is it possible to reduce H to $\{a\}$? Prove your answer.
- 3) Show that H_{ALL} is not in D by reduction from H .
- 4) For each of the following languages L , state whether or not it is in D . Prove your answer. Assume that any input of the form $\langle M \rangle$ is a description of a Turing machine.
- a) $\{\langle M \rangle : ab \in L(M)\}$.
- b) $\{\langle M, w \rangle : \text{TM } M, \text{ on input } w, \text{ begins by moving right one square onto } w. \text{ Then it never moves off } w\}$.
- c) $\{\langle M \rangle : \text{there exists a string } w \text{ such that } |w| < |\langle M \rangle| \text{ and that } M \text{ accepts } w\}$.
- 5) In Appendix J.2, we proved Theorem J.1, which tells us that the safety of even a very simple security model is undecidable, by reduction from H_ϵ . Show an alternative proof that reduces $A = \{\langle M, w \rangle : M \text{ is a Turing machine and } w \in L(M)\}$ to the language Safety.