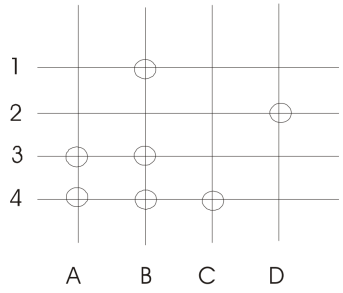
CS 341 Automata Theory
STUDENT NAME - EID
Homework 13
Due: Tuesday, April 17

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.

Solution. □

b) Use the graph algorithm we describe to find a coloring of G.

Solution. □

2) In this problem, we consider the relationship between H and a very simple language $\{a\}$.

a) Show that $\{\mathtt{a}\}$ is *mapping* reducible to H.

Solution. □

b) Is it possible to reduce H to $\{\mathtt{a}\}$? Prove your answer.

Answer. □

Proof. □

3) Show that H_{ALL} is not in D by reduction from H.

Solution. □

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) $\{\langle M \rangle \ : \ \mathtt{ab} \in L(M)\}$.

Answer. □

Proof. □

b) $\{\langle M, w \rangle$: TM M, on input w, begins by moving right one square onto w. Then it never moves off $w\}$.

Answer. □

Proof. □

c) $\{\langle M \rangle$: there exists a string w such that $|w| < |\langle M \rangle|$ and that M accepts $w\}$.

Answer. □

Proof. □

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 $A = \{\langle M, w \rangle : M$ is a Turing machine and $w \in L(M)\}$ to the language Safety.

Proof. □