CSCI 341 Problem Set 1

Games and State Machines; Automata

Due Monday, September 1

Games and State Machines

Problem **1** (Always an Upper Bound)**.** Let $M = (G, L, S, E, A, C)$ be a directional maze with the set of legal moves $A = \{\Uparrow, \Rightarrow\}$. Prove that $\mathcal{S}(M)$ is finite (there are only finitely many elements) by calculating an upper bound on the number of all possible legal paths through an $n \times m$ directional maze.

Problem **2** (Deja Vu)**.** Let B be a Sokoban game that is not already in a winning position (there is a finishing position without a box on it). Prove that if B has a nonempty solution space, then it has an infinite solution space.

Problem **3** (Reverse Engineering)**.** Find a Sokoban game that represents state s_1 in abstract state diagram (A). Replace the states in the state diagram with drawings of each state of the Sokoban game.
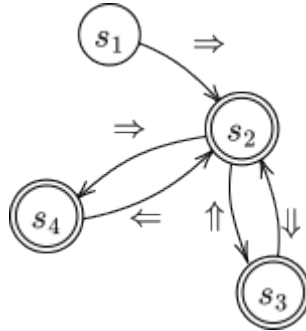

Figure 1: Abstract state diagram (A).

Problem **4** (Impossibility)**.** Prove that there *does not* exist a directional maze that represents state s_1 in abstract state diagram (A).

Automata

Problem **5** (Functional Determinism)**.** Let $\mathcal{A} = (Q, A, \delta, F)$ be an automaton. Prove that $\mathcal{A}$ is a deterministic and total if and only if δ is a function $\delta \colon Q \times A \to Q$.