CS 5000: Theory of Computation
Assignment 1: Deterministic Finite Automaton (DFA) Control for Robotic Camera-Arm Unit in 3-Block World

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Learning Objectives

1. Deterministic Finite Automata
2. Sussman's Anomaly
3. DFA in Robot Control

Problem 01: Control DFA for a Robotic Camera-Arm Unit in the Blocks World (3 points)

Design a deterministic finite state automaton (DFA) for controlling a robot camera-arm unit in a three-block world shown in **Figure 1**. You may want to use a strategy similar to the one discussed in the second lecture. The unit consists of one camera and one arm. The blocks **A**, **B**, and **C** are on top of the table **T**. You may assume that the unit has the following physical and perceptual capabilities.

1. **puton(X, Y)** - grab **X**, place **X** on top of **Y**, and release it, where **X** is a block and **Y** is either a block or a table;
2. **clear(X)** - predicate that evaluates to true if the top of **X** is clear, where **X** is a block;
3. **on(X, Y)** - predicate that evaluates to true if **X** is on top of **Y**, where **X** is a block and **Y** is either a block or a table.

Figure 1. Camera-Arm Unit

Design a DFA control for the unit that allows it to construct all possible towers, i.e., **ABC**, **ACB**, **BAC**, **BCA**, **CAB**, and **CBA**, where the notation **XYZ** means that the block **X** is on the block **Y**, the block **Y** is on the block **Z**, and the block **Z** is on the table. Assume that the state in **Figure 1** is the start state.

Problem 02: A DFA for the Sussman Anomaly (2 points)

The Sussman Anomaly is a famous AI problem in automated planning named after its inventor Gerald Sussman. Dr Sussman used this problem to illustrate a weakness of linear planning algorithms. Read about the Sussman anomaly at https://en.wikipedia.org/wiki/Sussman_Anomaly and design a DFA for the 3-block camera-arm unit that solves it.

You do not have to be too formal when specifying your DFA. Careful and clear drawings are sufficient. Also, illustrate your how your DFA work on a few test cases.

What to Submit

Use your favorite editor, LaTeX, OpenOffice Writer, MS-Word and so on, to type your solutions, convert the document into CS5000_F15_HW01.pdf and submit it through Canvas.