\documentclass[10pt]{article}

% math fonts

\usepackage{amsmath,amsfonts,amsthm,amssymb}

% to insert graphics

\usepackage{graphicx}

% to change margins of the pages

\usepackage[margin=0.9in]{geometry}

% Makes equations flush left

\usepackage{fleqn}

% This generates a page header with your name in it.

\usepackage{fancyhdr}

\pagestyle{fancy}

\fancyhf{}

\lhead{FOCS Fall 2018}

\rhead{HW11 solution by Sriyuth Sagi}

\rfoot{Page \thepage}

% This package makes it easy to have boxes around large text.

\usepackage{framed}

\begin{document}

{\bf Rosen 13.2, Exercise 10:} \\

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Construct a finite-state machine that changes every other bit, starting with the second bit, of an input string, and leaves the other bits unchanged.\\

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\\

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{\bf Rosen 13.2, Exercise 14:} \\

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Construct a finite-state machine for entering a security code into an automatic teller machine (ATM) that implements these rules: A user enters a string of four digits, one digit at a time. If the user enters the correct four digits of the password, the ATM displays a welcome screen. When the user enters an incorrect string of four digits, the ATM displays a screen that informs the user that an incorrect password was entered. If a user enters the incorrect password three times, the account is locked.\\

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Assume the correct password is $a$ $b$ $c$ $d$.\\

On the other hand, $x$ will represent an incorrect answer.\\

\includegraphics[width=\textwidth]{13\_2\_14.png}

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{\bf Rosen 13.2, Exercise 16:} \\

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Construct a finite-state machine that gives an output of 1 if the number of input symbols read so far is divisible by 3 and an output of 0 otherwise.\\

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{\bf Rosen 13.3, Exercise 40(c):} \\

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Use Exercise 39 and finite-state automata constructed in Example 6 to find deterministic finite-state automata that recognize each of these sets.

c) the set of bit strings that contain at most one 0 (that

is, that do not contain at least two 0s)\\

\\

\\

Final States = $S\_0,S\_1$\\

Non-final States = $S\_2$\\

\includegraphics[width=\textwidth]{13\_3\_40\_c\_.png}

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{\bf Rosen 13.3, Exercise 48:} \\

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In Exercises 48 find the language recognized by the given nondeterministic finite-state automaton.\\

\includegraphics[width=9cm]{q13\_3\_48.png}\\

\\

\\

\begin{tabular}{c | c | c}

\hline

State & 0 & 1\\ [0.5ex]

\hline\hline

$s\_0$ & $s\_0$,$s\_1$ & $s\_1$\\

$s\_1$ & $s\_1$ & $s\_2$, $s\_3$\\

$s\_2$ & $s\_2$,$s\_4$ & $s\_4$\\

$s\_3$ & $s\_4$,$s\_5$ & $s\_5$\\

$s\_4$ & $s\_4$ & $s\_5$\\

$s\_5$ & $s\_5$ & $s\_5$\\ [1ex]

\end{tabular}\\\\

The finite states are $s\_0$, $s\_1$ and $s\_4$\\\\

Options include:\\

Staying and looping at $s\_0$ or moving to $s\_1$ using input of 0.\\

$0^n$\\\\

Looping or not looping at $s\_0$ before using input of 1 to move to $s\_1$ and looping or not looping at $s\_1$.\\

$0^n10^m$\\\\

Looping or not looping at $s\_0$ before using input of 1 to move to $s\_1$ and looping or not looping at $s\_1$. Following which, using 1 to go to either $s\_2$ or $s\_3$. If at $s\_2$ possibly loop a few times before using 0 from either $s\_2$ or $s\_3$ to reach $s\_4$ and looping or not looping at $s\_4$.\\

$0^n10^m10^x$\\

Note: $x \geq 1$\\\\

Looping or not looping at $s\_0$ before using input of 1 to move to $s\_1$ and looping or not looping at $s\_1$. Following which, using 1 to go to $s\_2$. Can possibly loop a few times before using 1 to reach $s\_4$ and looping or not looping at $s\_4$.\\

$0^n10^m10^p10^q$\\

\\\\\\

$L(M) = \{0^n,$ $0^n10^m,$ $0^n10^m10^x,$ $0^n10^m10^p10^q$ $|$ $n,m,p,q \geq 0,$ $ x \geq 1 \} $

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{\bf Rosen 13.3, Exercise 54:} \\

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Find a deterministic finite-state automaton that recognizes the same language as the nondeterministic finite-state automaton in Exercise 47.\\

\\

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\end{document}