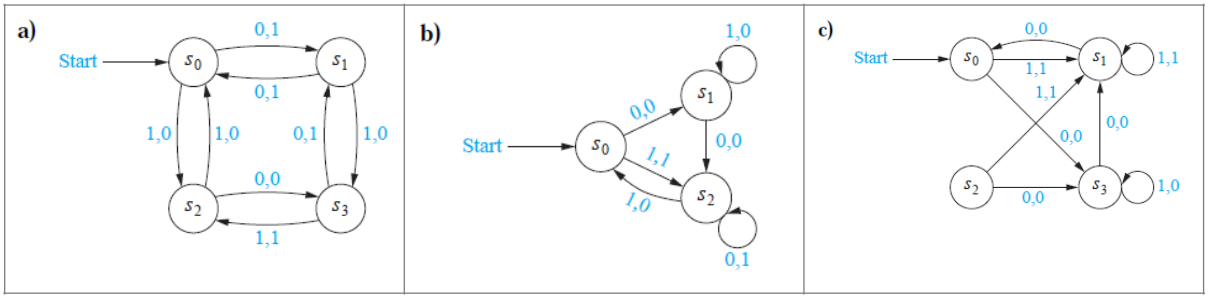
CS330 Homework 8[*]

1. Points = 10. Let $V = \{S, A, B, a, b\}$ and $T = \{a, b\}$. Find the language generated by the grammar (V, T, S, P) when the set P of productions consists of
   1a. $S \to A\,B,\ \mathrm{A} \to a\,b,\ \mathrm{B} \to b\,b.$
   1b. $S \to A\,B,\ S \to a\,A,\ A \to a,\ B \to b\,a$
   1c. $S \to A\,B,\ S \to A\,A,\ A \to a\,B,\ \mathrm{A} \to a\,b,\ B \to b.$
   1d. $S \to A\,A,\ S \to B,\ A \to a\,a\,A,\ A \to a\,a,\ B \to b\,B,\ B \to b$
   1e. $S \to AB,\ A \to aAb,\ B \to bBa,\ A \to \lambda,\ B \to \lambda$

2. Points = 4.
   2a. Show that grammar G_1 $\{V = \{S, 0, 1\}$; terminals $T = \{0, 1\}$; and productions $S \to 0\,S$, $S \to S\,1$, and $S \to \lambda\}$ generates the set $\{0^m 1^n \mid m, n = 0, 1, 2, \ldots\}$.
   2b. Show that grammar G_2 $\{ V = \{S, A, 0, 1\}$; terminals $T = \{0, 1\}$; and productions $S \to 0\,S,\ S \to 1\,A,\ S \to 1,\ A \to 1\,A,$ $A \to 1$, and $S \to \lambda\}$ generates the same set.

3. Points = 8. Find a phrase-structure grammar for each of these languages (multiple solutions exist).
   3a. The set consisting of the bit strings 10, 01, and 101
   3b. The set of bit strings that start with 00 and end with one or more 1s
   3c. The set of bit strings consisting of an even number of 1s followed by a final 0.
   3d. The set of bit strings that have neither two consecutive 0s nor two consecutive 1s.

4. Points = 6. Find the output generated from the input string 10001 for each finite-state machine shown.



5. Points = 6. Construct a finite-state machine for a combination lock that contains numbers 1 through 40 and that opens only when the correct combination, 10 right, 8 second left, 37 right, is entered. Each input is a triple consisting of a number, the direction of the turn, and the number of times the lock is turned in that direction.

---

* Some material from MATH230 Dr. Robert Ellis IIT-AMAT, zyBooks Disc. Math., and Disc. Math. and its Appl., Rosen (7th Ed.) is included under the academic/nonprofit Fair Use exception of US Copyright Law. This document must NOT be distributed beyond participants in IIT's CS330.