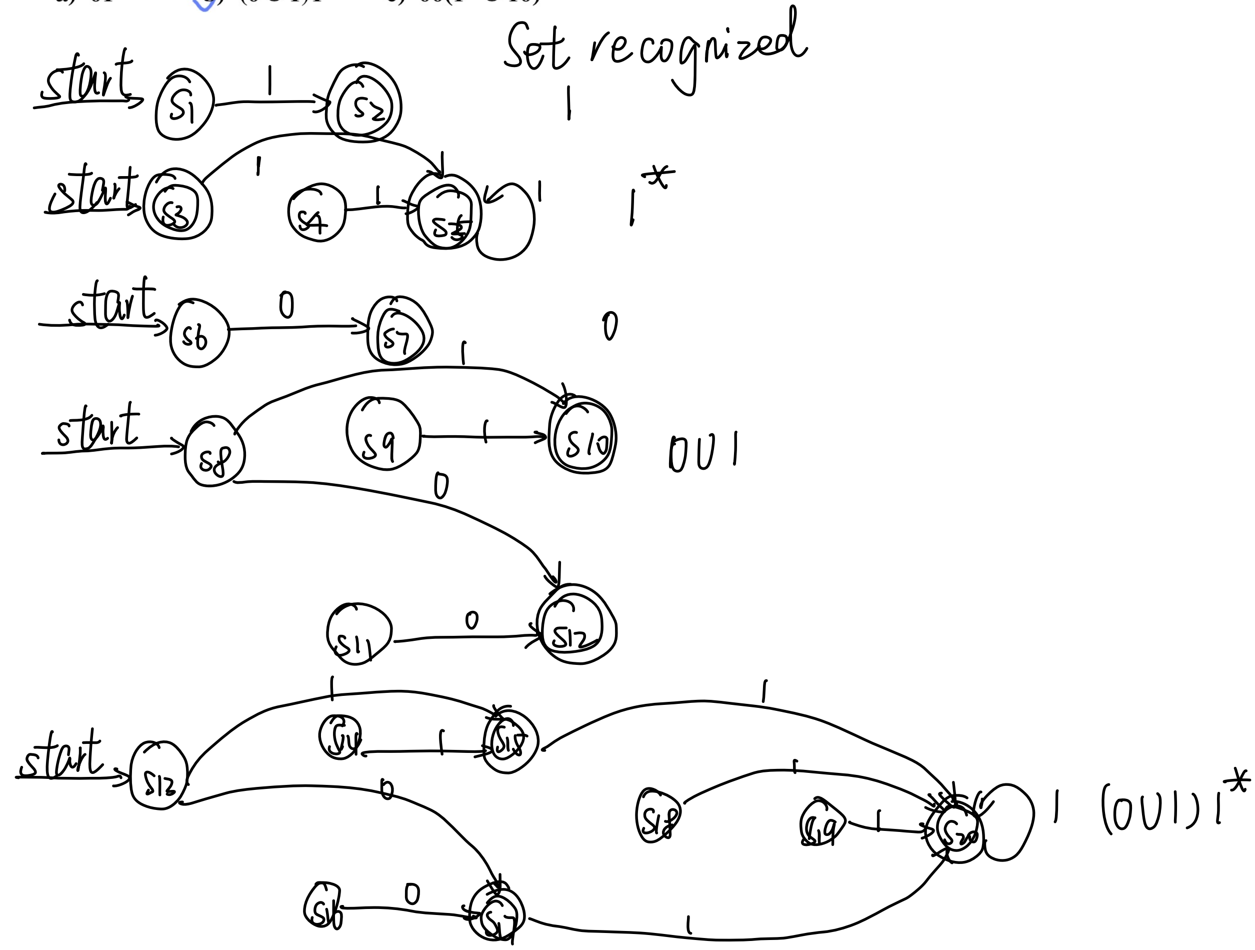
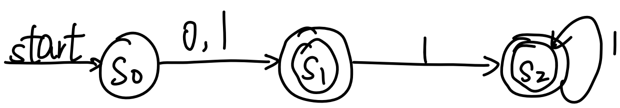
12. Using the constructions described in the proof of Kleene's theorem, find nondeterministic finite-state automata that recognize each of these sets.

a) 01^* b) $(0 \cup 1)1^*$ c) $00(1^* \cup 10)$





$(0 \cup 1)1^*$

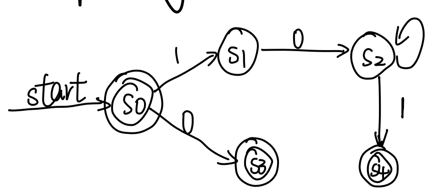
14. Construct a nondeterministic finite-state automaton that recognizes the language generated by the regular grammar $G = (V, T, S, P)$, where $V = \{0, 1, S, A, B\}$, $T = \{0, 1\}$, S is the start symbol, and the set of productions is

a) $S \to 0A$, $S \to 1B$, $A \to 0$, $B \to 0$.

b) $S \to 1A$, $S \to 0$, $S \to \lambda$, $A \to 0B$, $B \to 1B$, $B \to 1$.

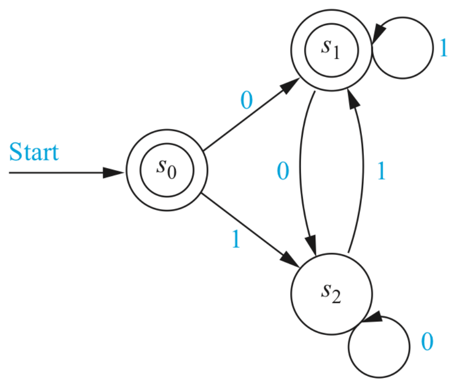
c) $S \to 1B$, $S \to 0$, $A \to 1A$, $A \to 0B$, $A \to 1$, $A \to 0$, $B \to 1$.

Suppose s_0 is the state corresponding S, s_1 is the state corresponding A. s_2 is the state corresponding B. s_3 and s_4 are corresponding final state



In Exercises 15–17 construct a regular grammar $G = (V, T, S, P)$ that generates the language recognized by the given finite-state machine.

16.



$G=(V,T,S,P)$ where

$V=\{0,1,S,A,B\}$, $T=\{0,1\}$

$P=\{S_0\to\lambda,\ S_0\to 0A,\ S_0\to 1B,\ B\to 1A,$
$B\to 0B,\ A\to 0B,\ A\to 1A,\ A\to\lambda\}$

$L(G)=\{(0\cup1)^*0^m1^n \mid m,n$ are non-negative integers$\}$

2. Let T be the Turing machine defined by the five-tuples: $(s_0, 0, s_1, 0, R)$, $(s_0, 1, s_1, 0, L)$, $(s_0, B, s_1, 1, R)$, $(s_1, 0, s_2, 1, R)$, $(s_1, 1, s_1, 1, R)$, $(s_1, B, s_2, 0, R)$, and $(s_2, B, s_3, 0, R)$. For each of these initial tapes, determine the final tape when T halts, assuming that T begins in initial position.

a)

...	B	B	0	1	0	1	B	B	...

b) ✓

...	B	B	1	1	1	B	B	B	...

c)

...	B	B	0	0	B	0	0	B	...

d)

...	B	B	B	B	B	B	B	B	...

S_0

...	B	B	1	1	1	B	B	B	...

S_1

...	B	B	0	1	1	B	B	B	...

S_2

...	B	0	0	1	1	B	B	B	...

8. Construct a Turing machine with tape symbols 0, 1, and B that, given a bit string as input, replaces all 0s on the tape with 1s and does not change any of the 1s on the tape.

$(S_0, 0, S_1, 1, R)$, $(S_1, 0, S_1, 1, R)$ $(S_1, 1, S_2, 1, R)$ (S_1, B, S_3, B, R)
$(S_0, 1, S_2, 1, R)$ $(S_2, 1, S_2, 1, R)$ $(S_2, 0, S_1, 1, R)$ (S_2, B, S_3, B, R)

18. Construct a Turing machine that computes the function $f(n) = n + 2$ for all nonnegative integers n.

assuming that T begins in initial position

$(S_0, 1, S_1, 1, L)$ $(S_1, B, S_2, 1, L)$ $(S_2, B, S_3, 1, L)$