1.37 draw a machine for $n=3$

1.48 try to think of a short description of the language

Complexity Theory

Computability Theory algorithms

Turing/Church/Godel

Automata Theory mathematical model for computation.

Set

Relation | equivalence — ① Reflexive ② Symmetric ③ transitive

Function — no repeated first element.

Russell's paradox

alphabet any nonempty finite set

string finite sequence of elements from the alphabet

language any set of strings over an alphabet

substring , empty string (ϵ) , concatination

string with length of 0. $u \circ v = uv$

Ch1 Regular Languages

State Deterministic

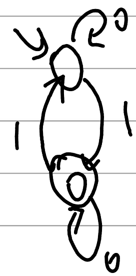
Def A finite automaton (FA, FSA, DFSA)
is a 5-tuple $(Q, \Sigma, \delta, q_0, F)$

1) Q is a finite set (Ω states)
2) Σ is a finite set (alphabet)
3) $\delta : Q \times \Sigma \to Q$ is a <u>function</u> (transition)
   no missing arrow
   extra
4) $q_0 \in Q$ (initial state)
5) $F \subseteq Q$ (the set of accepting/final states)

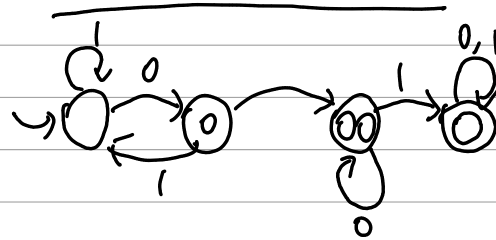
Def If M is a FA, then $L(M)$, the language of M, is the set of all strings accepted by M.

Def A string $w = w_1 w_2 \cdots w_n$ is <u>accepted</u> by a FA, M, if there exists a sequence of states $r_0, r_1, \ldots, r_n$ such that 1) $r_0 = q_0$ 2) $r_n \in F$ 3) $\delta(r_i, w_{i+1}) = r_{i+1}$ for $i = 0, \ldots, n-1$

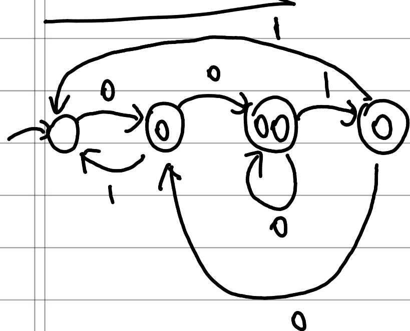
Odd # of 1



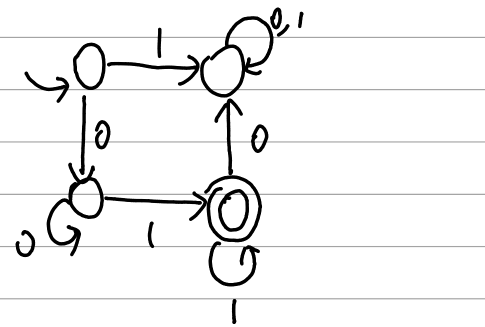
Contain subset of 001



End in 001



1) Contain at least one 0 and one 1
2) all 0's come before all 1's



Contain more 0's than 1's

not regular ⇒ impossible to achieve in FA

Regular Operations (on languages)

Union: $A \cup B = \{x \mid x \in A \vee x \in B\}$

Concatenation: $A \circ B = \{w \mid w = xy \text{ where } x \in A \wedge y \in B\}$

Star: $A^* = \{w \mid w = x_1 x_2 \ldots x_n \text{ for some } n \geq 0,$
(Kleene star) $\quad x_i \in A \text{ for all } i = 0, 1, \ldots, n\}$
?

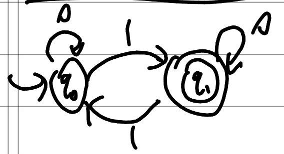
null string $\epsilon \in A^*$, always.

Closure Properties

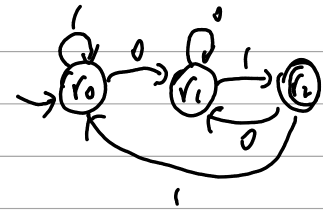
A set S is closed under an operation (op) if
$(s \text{ op } t) \in S$ for all $s, t \in S$.

Theorem If A and B are regular languages,
then so is $A \cup B$.
(regular languages are closed under union ($\cup$).)

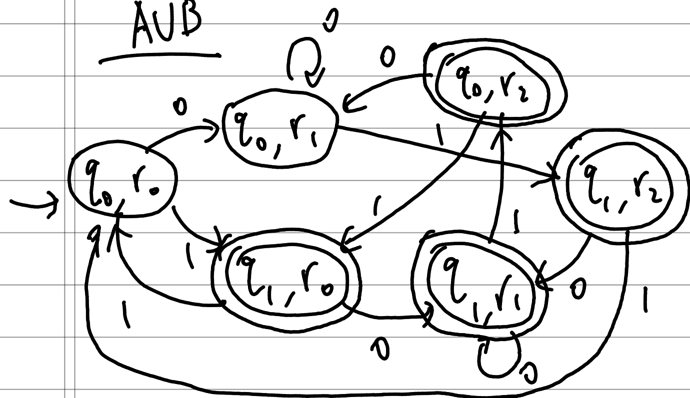
A = odd # of 1's



B = ends in 01



A∪B



$A = \{Q, \Sigma, q_0, \delta_A, F_A\}$

$B = \{R, \Sigma, r_0, \delta_B, F_B\}$

if $= F_A \times F_B$, then under intersection

$A \cup B = \{Q \times R, \Sigma, (q_0, r_0), \delta, \overline{F_A \times R \cup Q \times F_B}\}$

$\delta :: (Q \times R) \times \Sigma \to (Q \times R)$

$\delta((q, r), s) = (\delta_A(q, s), \delta_B(r, s))$