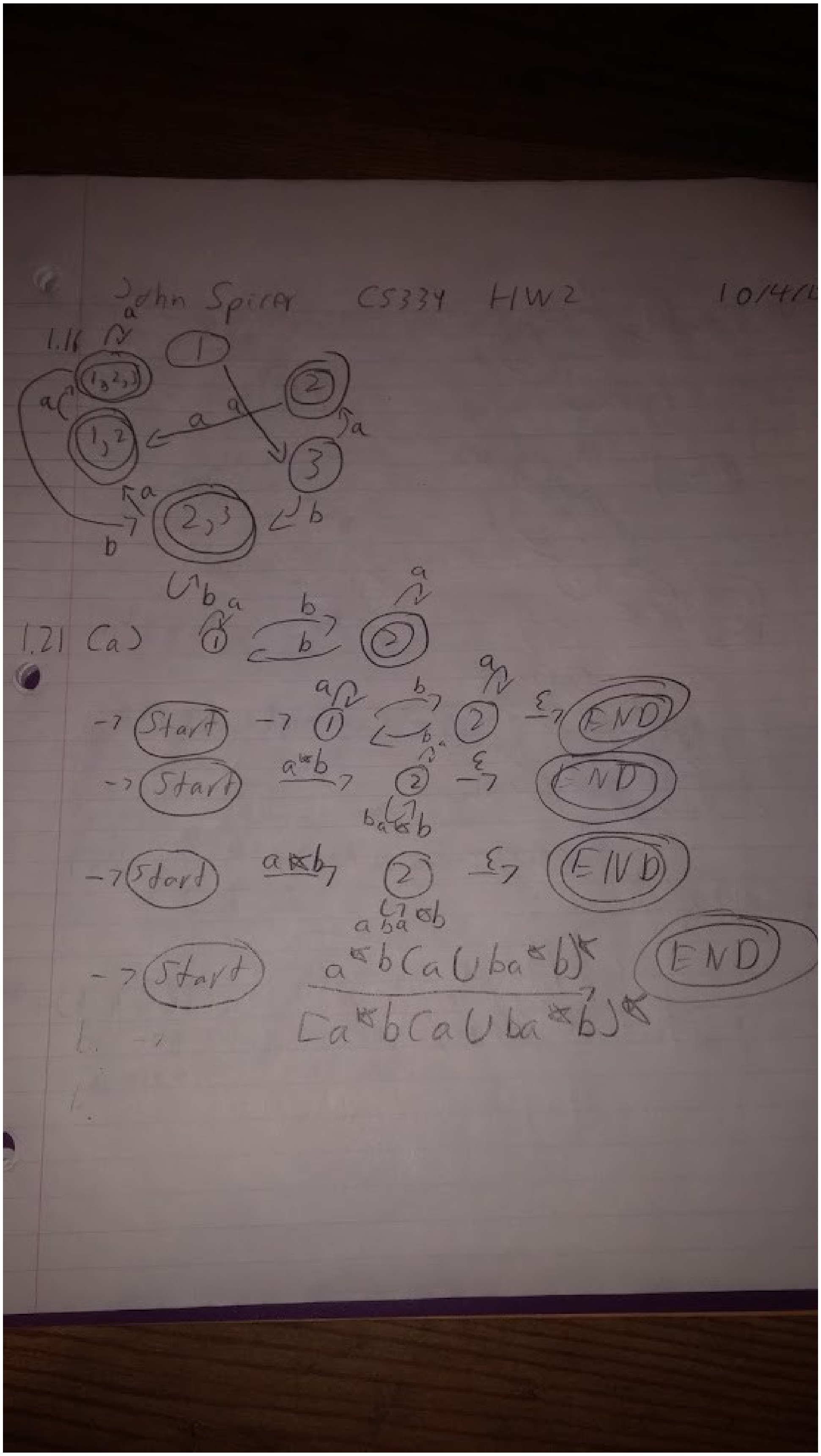
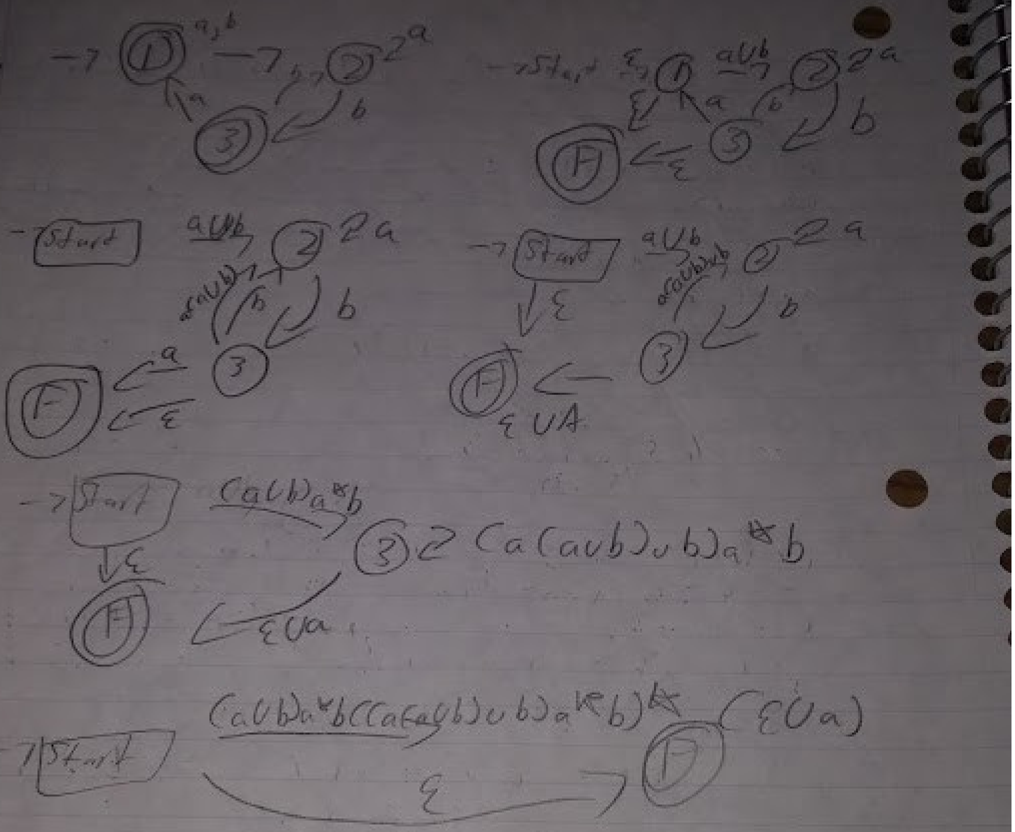
John Spicer
I pledge my Honor that I have abided by the Stevens Honor System.



b.



$(\varepsilon \cup (a \cup b)a^*b((a(a \cup b) \cup b)a^*b)^*$
$(\varepsilon \cup a)$

1.4 $\{w \mid w = a_1 b_1 \ldots a_k b_k$ where $a_1 \ldots a_k \in A$ & $b_1 \ldots b_k \in B$ each $a_i b_i \in \Sigma\}$

$M_1 = (Q_1, \Sigma, \delta_1, S_1, F_1)$ DFA for language A
$M_2 = (Q_2, \Sigma, \delta_2, S_2, F_2)$ DFA for language B
$M = (Q, \Sigma, \delta, S, F)$ DFA for perfect shuffle of A & B

$Q = Q_1 \times Q_2 \times \{1, 2\}$. set of possible states of M
. $S_0 = \{S_1, S_2, 1\}$. S_1 initial state in M_1, S_2 initial state in M_2, M starts w/ 1

$F = \{(a_1, a_2, 1) \mid a_1 \in F_1 \cap a_2 \in F_2\}$
. $\delta((a_1, a_2, 1), a) = (\delta_1(a_1, a), a_2, 2)$ $b=1$
M . current state is a_1, M_2 is a_2

$\delta((a_1, a_2, 2), b) = (a_1, \delta_2(a_2, b), 1)$ $b = 2$
By proving M to recognize the perfect shuffle of A & B, it is a regular language & therefore the class of regular languages is closed under a perfect shuffle

$\{w \mid$ the length of w is odd$\}$
the CFG is given by
$S \to 0 \mid 1 \mid 0 0 S \mid 0 1 S \mid 1 0 S \mid 1 1 S$

$\{w \mid w = w^R$, w is a palindrome$\}$
CFG:
$S \to 0 \mid 1 \mid 0 S 0 \mid 1 S 1 \mid \varepsilon$

1.51 Let x and y be strings and L be any Language

Distinguishable if only one of the strings xz and yz belongs to L (z is also a strings)

Indistinguishable if for every z, $xz \in L$ whenever $yz \in L$

Equivalence Relation: Reflexive, Symmetric, + Transitive

Reflexive - $x \equiv_L x$
For all strings, xz is in L iff xz is in L
∴ True Reflexive!

Symmetric - $x \equiv_L y$ implies $y \equiv_L x$
if $x \equiv_L y$ true, "for all z, xz is in L iff yz is in L" is = to "for all z, yz is in L iff xz is in L" ∴ $y \equiv_L x$ is also true
Symmetric!

Transitive - if $a \equiv_L b$ ÷ $b \equiv c$ then $a \equiv_L c$
So "For all z, az is in L iff bz is in L"
∴ "For all z, az is in L iff cz is in L"
∴ ($a \equiv_L c$ true) Transitive!

Reflexive! Symmetric! Transitive! => $\equiv_L$ is an equivalence relation

2.9 $A = \{a^i b^j c^k \mid i = j \text{ or } j = k \text{ where } i, j, k \geq 0\}$

$A = \{a^i b^j c^k \mid i = j \text{ where } i, j, k \geq 0\} \cup \{a^i b^j c^k \mid j = k \text{ where } i, j, k \geq 0\}$

$A_1 = \{a^i b^j c^k \mid i = j,\ i, j, k \geq 0\}$

$A_2 = \{a^i b^j c^k \mid j = k\ i, j, k \geq 0\}$ $\quad S \to E_1 \mid E_2$

Language post union $E \to E_1 \mid E_2$

In A_1, $i = j \to$ same # of a & b

$E_1 \to E_1 c \mid A$

$A \to aAb \mid$

In A_2, $j = k \to$ same # of b & c

$E_2 \to a E_2 \mid B$

$B \to bBc \mid \varepsilon$

$S \to E_1 \mid E_2$

$E_1 \to E_1 c \mid A$

$E_2 \to a E_2 \mid B$

$A \to aAb \mid \varepsilon$

$B \to bBc \mid \varepsilon$

$S \to E_1 \to E_1 c \to Ac \to aAbc \to abc$

$S \to E_2 \to aE_2 \to aB \to abBc \to abc$

the CFG is ambiguous because we can have two definitions of abc

Regular Languages are generated by regular grammars

So if $L = \{v_1, v_2, \ldots v_n\}$

$$\left.\begin{array}{l} S \to v_1 \\ S \to v_2 \ldots \\ S \to v_2 \end{array}\right\}$$ is a regular la[nguage] of L

1.29 a. $A_1 = \{0^n 1^n 2^n \mid n \geq 0\}$ p is pumping length

$s = 0^p 1^p 2^p$ $s = xyz$ $i \geq 0$ xy^iz is in A_1

1. String y is only 0s, only 1s, or only 2s. $xyyz$ will not have an even # of 0s, 1s & 2s $\therefore$ $xyyz$ is not a member of A_1

2. String y has more than one type of symbol. $xyyz$ is not a member of A_1

Both cases $xyyz$ is not a member. $\therefore$ A_1 is not regular.

b. $\mathcal{J}$