Cpt S 317 Mid-term

1. (12 pts)

(1)(4pts). Write down a regular expression for the following language: all strings (on $\{0,1\}$) that contain 101 as a substring.

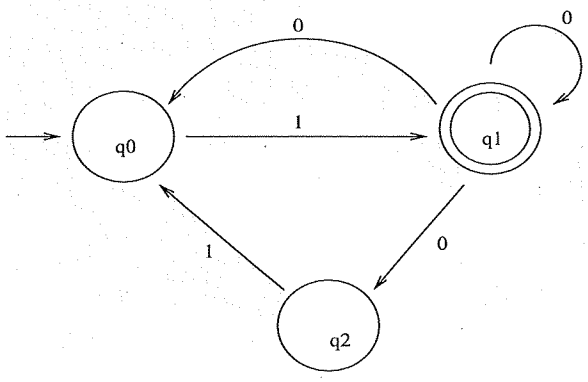
(2)(4pts). Write down a regular expression for the following language: all strings (on $\{0,1\}$) that contain both 101 and 010 as substrings.

(3)(2pts). Is there a word that is both in $1(0+1)^*1$ and in $(0+1)^*0$?

(4) (2pts). Write down a regular expression for the following language: all strings (on $\{0,1\}$) that do not end with 0.

2. (10 pts) Draw a finite automaton (DFA, NFA, or Λ-NFA, at your choice) accepting $01((101+10)^*+10)^*01$.

3. (10 pts) Convert the following NFA into a DFA using subset construction:



4. (10 pts) Use structural induction to show that, if L is a regular language, then so is $Start(L,a)$ that is the set of words in L started with a.

5. (5 pts) List all words with length 2 in $(a+b)(b+c^*)(a^*+b)$.

6. (5 pts) Let M be a DFA with 256 states and let P be a C-program that uses the smallest amount of memory to implement M. How much memory does P use? Briefly state your reasoning.

7. (5 pts) Let L_1, L_2 and L_3 be three regular languages. Define L to be the set of all w satisfying: $w \in L_1$ and $w \notin L_2$ and $w \notin L_3$. Show that L is also regular. (Hint: we know that regular languages are closed under a few set operations.)

question 5)

List all words with length 2 $(a+b)(b+c^*)(a^*+b)$.

solution: $\{aa, ab, ac, ba, bb, bc\}$

question 6)

Let M be a DFA with 256 states and let P be a C-program that uses the smallest amount of memory to implement M. How much memory does P use? Briefly state your reasoning.

$\{b,b\}$

question 7)

$L = \{w \mid w L_1 \text{ and } w L_2 \text{ and } w L_3\}$

$= \{w \mid w L_1 \text{ and } w L_2\}$

$= L_1 \cap L_2$

$= \{w \mid w L_1 \text{ or } w L_2\}$

$= L_1 \cup L_2$

$= \{w \mid w L_1 \text{ and } w L_2 \text{ and } L_3\}$

$= L_1 \cap L_2 \cap L_3$

$= \{w \mid w L_1 \text{ and } w L_2 \text{ and } w L_3\}$

$= L_1 \cap L_2 \cap L_3$

$= L$ → L is reg expression

ACCESS CENTER
Proctoring 335-8079 Fax 335-3345
Washington Building 216 K
Pullman WA 99164-2322

Mark Shinozaki

Cpts 317

question 1)

write down a regular expression for the following language: all strings (on $\{0,1\}$) that contain 101 as a substring.

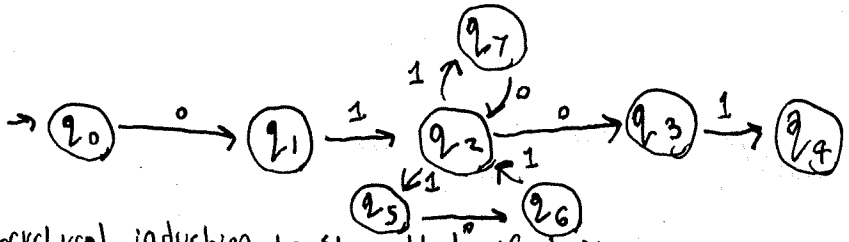
1) $(0+1)^*(101)(0+1)^*$

2) $(0+1)^*(101)(0+1)^*(010)$

3) No common word

(4) $(0+1)^*1$

question 2) Draw a finite automaton (DFA, NFA, Λ-NFA, at your choice) accepting $01((101+10)^*+10)^*01$.



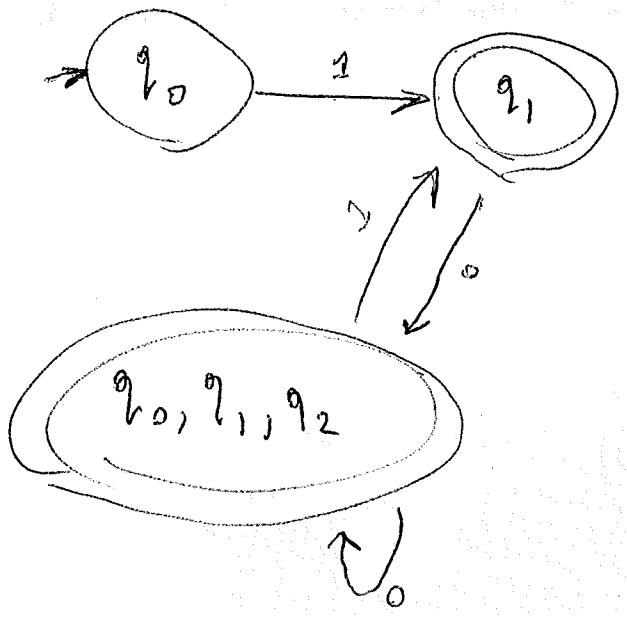
question 4) use structural induction to show that, if L is a regular language, then so is Start(L, a) that is the set of words in L started with a.

~~NIF~~

• If L is empty, then Start(L, a) is empty. Inductive case: Let $L = \{w \mid w \in I \wedge w_1 w_2 \ldots w_n \in L\}$ and we can suppose Start(L, a) is regular. We show $(L, a) = \{w \mid w \in I \wedge wa \in$ Start(L, a) is regular.

Let $R = \{w \mid w \in I \wedge wa \in$ Start(L, a)$\}$ be the set of all words that start with the same character as a. By definition of regular language R is regular. In this case, the rule is that the string must start with the same character as a.

ACCESS CENTER
Proctoring 335-8079 Fax 335-3345
Washington Building 216 K
Pullman WA 99164-2322

question 3 →

Question 3: