

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.

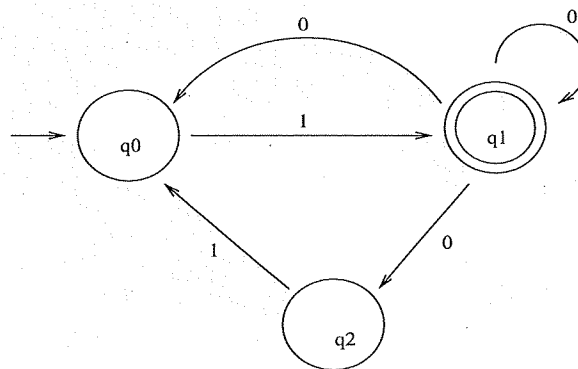
– (2)(4pts). Write down a regular expression for the following language: all strings (on $\{0, 1\}$) that contain both 101 and 010 as substrings.

– (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.)

Introduction

The purpose of this study is to investigate the effects of various factors on the growth and development of the human body. The study is designed to explore the relationship between nutrition, exercise, and the overall health of the individual. The research is conducted in a controlled environment, where the subjects are monitored over a period of six months. The data collected will be used to develop a comprehensive model of human growth and development, which can be used to inform public health policies and individual health decisions.

The study is divided into three main sections: the first section focuses on the effects of nutrition on growth and development, the second section focuses on the effects of exercise, and the third section focuses on the combined effects of both factors. The subjects are selected based on their age, sex, and initial health status. The study is conducted in a controlled environment, where the subjects are monitored over a period of six months. The data collected will be used to develop a comprehensive model of human growth and development, which can be used to inform public health policies and individual health decisions.

The study is designed to explore the relationship between nutrition, exercise, and the overall health of the individual. The research is conducted in a controlled environment, where the subjects are monitored over a period of six months. The data collected will be used to develop a comprehensive model of human growth and development, which can be used to inform public health policies and individual health decisions.

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.

8 bits

Question 7)

$$L = \{w \mid wL_1 \text{ and } wL_2 \text{ and } wL_3\}$$

$$= \{w \mid wL_1 \text{ and } wL_2\}$$

$$= L_1 \cap L_2$$

$$= \{w \mid wL_1 \text{ or } wL_2\}$$

$$= L_1 \cup L_2$$

$$= \{w \mid wL_1 \text{ and } wL_2 \text{ and } wL_3\}$$

$$= L_1 \cap L_2 \cap L_3$$

$$= \{w \mid wL_1 \text{ and } wL_2 \text{ and } wL_3\}$$

$$= L_1 \cap L_2 \cap L_3$$

$$= L \rightarrow L \text{ is regular}$$

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Question 1)

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

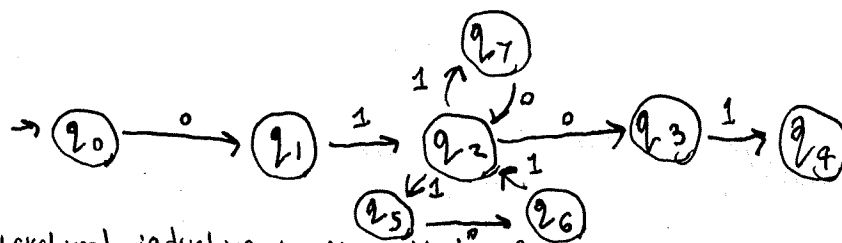
1) $(0+1)^* (101) (0+1)^*$

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

3) No common word

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

Question 12) Draw a finite automaton (DFA, NFA, Λ -NFA, at your choice) accepting $01((0+10|10)^* + 10)^* 01$.



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

~~NFA~~

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

Let $R = \{w \mid w \in I \wedge w_1 a \in \text{Start}(L, a)\}$ 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 .

question 3:

