CMPSC 461: Programming Language Concepts, Fall 2025
Assignment 1 Practice Notes Packet

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Problem 1: Regular Expression I [5 pts]

Given an alphabet {0, 1, 2, ..., 8, 9} construct a regular expression for strings that matches any four character string that does not end with the digits 4, 6, 1. Come up and write two different answers (There are more than two correct answers).

Problem 2: Regular Expression II [5 pts]

Given an alphabet {a,b,c,d,e} construct a regular expression that matches strings that contain the sub string ”ace” and ends in the letter ’b’.

Problem 3: Regular Expression III [5 pts]

Assuming all valid digits and special characters, construct a regular expression that matches integers from ranges [-461,-311] and [461, 572].

Problem 4: Regular Expression IV [5 pts]

Given the following regular expression a{4}b?[hello](goodluck) give the longest possible string that is matched by the regular expression. If it is infinite or null, explain why.

Problem 5: Regular Expression V [6 pts]

Write regular expressions for the following languages.

1. The set of strings of 0's and 1's whose tenth symbol from the right end is 1.
2. The set of strings of 0's and 1's with at most one pair of consecutive 1's.

Problem 6: Regular Expression VI [5 pts]

Give English descriptions of the languages of the following regular expressions.

1. $((10)^*000(01)^*$
2. $(0 \mid 10)^*1^*$

Problem 7: Regular Expression VII [5 pts]

Write down the set of strings recognized by the following regular expressions. If the set is infinite, write down the first 4 shortest elements.

1. $abc \mid (ed \mid f) \mid a$
2. $a^*(ab \mid b)^*$

Problem 8: Finite Automata I [8 pts]

Give NFAs with the specified number of states recognizing each of the following languages. In all cases, the alphabet is $\sum = \{0, 1\}$.

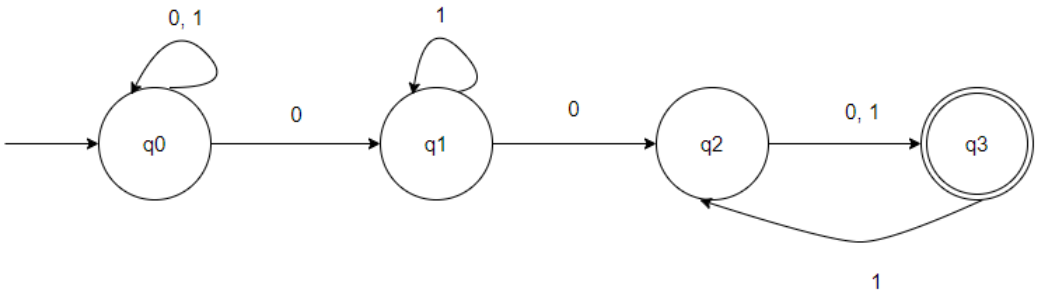
1. The language $\{ w \in \sum^* \mid w$ contains the substring 0101, i.e., w = x0101y for x, y $\in \sum^* \}$ with five states.
2. The language $\{ w \in \sum^* \mid w$ contains at least two 0s, or exactly two 1s $\}$ with six states.

Problem 9: Finite Automata II [7 pts]

1. What is a Finite Automata? Explain how it is related to regular languages. [2 pts]
2. For the given alphabet $\{a, b\}$, design a NFA which contains **ab** as substring (*e.g., ab, aab, bab, abab, aaba etc.*). Neatly describe the **initial state**, **accepting state**, and **transitions**, if any. [5 pts]

Problem 10: Finite Automata III [10 pts]

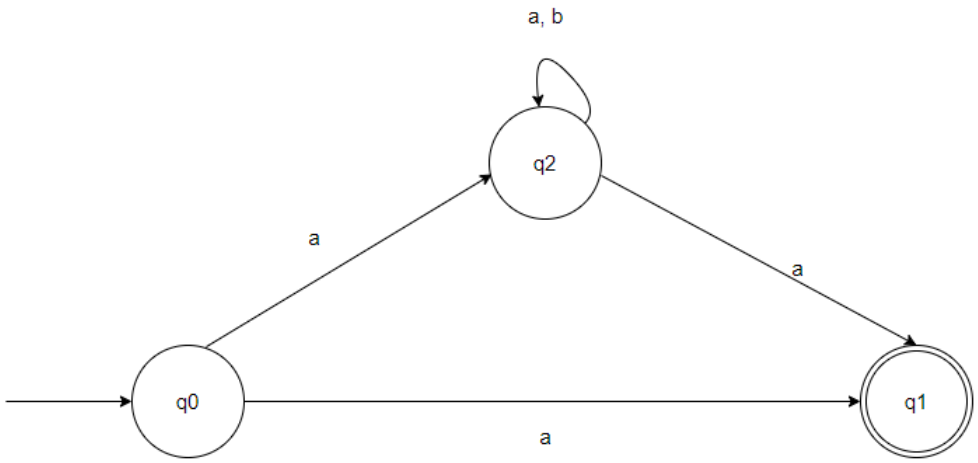
1. For the NFA given below, construct a DFA using subset construction method. Neatly describe the transition tables associated with it. [7.5 pts]



2. Is the language described by the above NFA regular? Explain your reasoning. [2.5 pts]

Problem 11: Finite Automata IV [10 pts]

1. For the NFA given below, construct a DFA using subset construction method. Neatly describe the transition tables associated with it. [7.5 pts]



2. Is the language described by the above NFA regular? Explain your reasoning. [2.5 pts]

Problem 12: Finite Automata V [8 pts]

Draw a deterministic finite automata which accepts a string containing "ing" at the end of a string in a string of a-z, e.g., "anything" but not "anywhere".