CSci 435: Formal Languages and Automata

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**Home Assignment 3: 100 points + 25 points (optional)**

Q1. [10]

1. Use the construction in Theorem 4.1 to find an DFA that accept L(*ab\*a*\*) ∩ L(*a\*b\*a*).
2. [5, Optional] Give the regular expression for the above language in 1) that is accepted by your DFA.

Q2. [10] The ***complementary or (cor)*** of two sets S1 and S2 is defined as

cor(L1, L2) = {*w* | *w* ∉L1 or *w* ∉ L2, }.

Show that the family of regular languages is ***closed*** under ***cor.***

Q3. [10] The family of regular languages are closed under arbitrary ***homomorphism***.

Prove or disprove h(L1 ∩ L2) =h(L1) ∩ h(L2) is a regular language where L1 and L2 are regular.

Q4. [10] Let L1 = {L(*b*\**abb*\*) and L2 = L(*bab*\*). Find the ***right quotient*** of L1 with L2, L1/L2.

1. [5] Let M be a DFA s.t. L(M) = L(L1). By applying Thm. 4.4, construct a DFA M’ s.t. L(M’) = L1/L2.
2. [5] Then, give a regular expression for L(M’) = L1/L2.

Q5. [10] If L is a regular language, prove that the language L2 = { *uv* | *u*∈ LR , *v* ∈L } is also regular.

Q6. [10] The ***left quotient*** of a regular language L1 with respect to L2 is defined as:

L2/L1 = { *y* | *x*∈ L2 , *xy* ∈L1 }

Show that the family of regular languages is ***closed*** under the ***left quotient*** with a regular language.

Hint: Do NOT construct a DFA that accepts L2/L1 but use the definition of L2/L1 and the closure

properties of regular language.

Q7. [10] Disprove that L1 = L1L2/L2 for all languages L1 and L2 . Give a counter example.

Q8. [10] A language is said to be a ***palindrome*** language if L = LR. (4.2-3)

Show that there exists an ***algorithm*** for determining if a given regular language is a palindrome language.

Q9. [20] Pumping Lemma

1. [10] Prove that the language L = {*anbkcn* | *n* ≥ 0, *k* ≥ *n* } is ***not regular***.
2. [10, Optional] Prove that the language L = {*w* | *na*(*w*) ≠ *nb*(*w*)} is ***not regular***.
3. [10] Prove or disprove that L1 ∪ L2 is not regular language if L1 and L2 are not regular languages.

Q10 [10, optional] The ***min*** of a language L is defined as

***min***(L) = { *w* ∈L | there is no *u* ∈L, *v*∈Σ+, such that *w* = *uv* }.

Show that the family of regular languages is closed under the ***min*** operation.