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Chapter 2 Group Project Questions

Question 4:

Let L = {w ∈ {a, b}\* : |w| ≡₃ 0}. List the first six lexicographic enumerations of L.

≡₃ represents a modulus of 3 on the cardinality of w. W in this example represents all possible combinations and lengths of a and b. Since the cardinality of w requires a modulus 3 of 0 the number must be divisible by three with no remainder. Therefore the first 6 enumerations in a dictionary like order are the following beginning with epsilon:

Question 5a:

Consider the language L of all strings drawn from the alphabet {a, b} that have at least two different substrings of length 2. Describe L by writing a sentence of the form L = {w ∈ Σ\* : P(w)}, where Σ is a set of symbols and P is a first-order logic formula (i.e., you can use ∀ and ∃ in addition to ¬, ∧, and ∨) You may use the function |s| to return the length of string s. You may use all the standard relational symbols (e.g., =, ≠, <, etc.), plus the predicate Substr(s, t), which is True iff s is a substring of t. Remember, a sentence is a WFF with no free variables.

First we must construct a language which represents all possible combinations of {a,b} without constraints.

However this is far from complete. We must add the constraint that there must be at least two different substrings of length two.

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|  |  | Equation 1 |

Walking through this means that there exists a x and y where the following constraints are met. Beginning with the fact that x cannot equal y because they must be two different substrings. The following two rules require that these substrings cardinality must equal 2 (their length must equal 2). The final two rules will only return true if these strings are substrings of w.

Question 7d:

Is L = {w ∈ {a, b}\* : w starts with 'a'} closed under reversal? If not, give an example.

This will not be closed under reversal. For example if we assume a string consisting of ‘abbb’. The reversal of this string ‘bbba’ does not exist in L. To complete this you would have to create a union of this language with a language that ends with a. The answer should be :

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|  |  | Equation 2 |

Question 7e:

Is L = {w ∈ {a, b}\* : w ends in 'a'} closed under concatenation? If not, give an example.

Yes this is closed under concatenation. Imagine that we had a string ‘bba’ now we know that the string ‘bbabb’ would not exist in the original language. But by concatenating ‘bb’ onto the string ‘bba’ we can create the string ‘bbabb’ which otherwise would have not originally existed in L.