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Automata

2-14-20

Homework 8

1. L­1 = { 0a1b0c | a+b > c }
   1. Let’s suppose L1 is accepted by some FA. choosing some string x = 0a1b0c such that x∈L1. Then, by pumping lemma, x = uvw such that, |uv| ≤ n, |v| > 0 and ∀ i ≥ 0, uviw ∈ L1. So all the symbols in u and v are 0’s. So we know that v = 0k for some k > 0. By the pumping lemma, uvvw ∈ L1 as well. This would make a string y with 0a+k1b0c. Since this string y ∈ L1, because a+b+k>c is still true, we can be confident that L1 is a regular language.
2. L2 = { 0a1b0c | a+b+c > 3 }
   1. Let’s suppose L2 is accepted by some FA. choosing some string x = 0a1b0c such that x∈L2. Then, by pumping lemma, x = uvw such that, |uv| ≤ n, |v| > 0 and ∀ i ≥ 0, uviw ∈ L2. So all the symbols in u and v are 0’s. So we know that v = 0k for some k > 0. By the pumping lemma, uvvw ∈ L2 as well. This would make a string y with 0a+k1b0c. Since this string y ∈ L2, because if a+b+c>3 is true, then a+b+k+c>3, we can be confident that L2 is a regular language.
3. L3 = { wwR | w ∈ {0,1}\* }
   1. Let’s suppose L3 is accepted by some FA. choosing some string x = wwR such that x∈L3. Then, by pumping lemma, x = uvw such that, |uv| ≤ n, |v| > 0 and ∀ i ≥ 0, uviw ∈ L3. So u = w and v is some non-zero amount of ws. So we know that v = wk for some k > 0. By the pumping lemma, uvvw ∈ L3 as well. This would make a string y with ww2k. Since this string y ∈ L3, because wwR | w ∈ {0,1}\*, where r = 2k is true. We can be confident that L3 is a regular language.
4. L4 = { w | w ∊ X, wR ∈ Y }, given any two regular languages X and Y (that share an alphabet)
   1. Since R is not actually used in the string which is being defined in the string, it should hold no relevance in the definition of L4. Thus a more concise statement of it is L4 = { w | w ∊ X} and we can assume this is a regular language given that X is already defined as a regular language.