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Automata

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Homework 8

1. L1 = { $0^a1^b0^c$ | a+b > c }
    a. Let's suppose L1 is accepted by some FA. choosing some string x = $0^a1^b0^c$ such that x∈L1. Then, by pumping lemma, x = uvw such that, |uv| ≤ n, |v| > 0 and ∀ i ≥ 0, uv^iw ∈ L1. So all the symbols in u and v are 0's. So we know that v = 0^k for some k > 0. By the pumping lemma, uvvw ∈ L1 as well. This would make a string y with $0^{a+k}1^b0^c$. 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 = { $0^a1^b0^c$ | a+b+c > 3 }
    a. Let's suppose L2 is accepted by some FA. choosing some string x = $0^a1^b0^c$ such that x∈L2. Then, by pumping lemma, x = uvw such that, |uv| ≤ n, |v| > 0 and ∀ i ≥ 0, uv^iw ∈ L2. So all the symbols in u and v are 0's. So we know that v = 0^k for some k > 0. By the pumping lemma, uvvw ∈ L2 as well. This would make a string y with $0^{a+k}1^b0^c$. 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 = { ww^R | w ∈ {0,1}* }
    a. Let's suppose L3 is accepted by some FA. choosing some string x = ww^R such that x∈L3. Then, by pumping lemma, x = uvw such that, |uv| ≤ n, |v| > 0 and ∀ i ≥ 0, uv^iw ∈ L3. So u = w and v is some non-zero amount of ws. So we know that v = w^k for some k > 0. By the pumping lemma, uvvw ∈ L3 as well. This would make a string y with ww^{2k}. Since this string y ∈ L3, because ww^R | 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)
    a. 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.