HW4

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1. Use the pumping lemma to prove that L = $\{ ww : w \in \{ 0, 1\} ^{*}\}$ is nonregular.

We will prove this by proof of contradition and assume that L is a regular language. So therefore for L, $\exists_n \in N$ such that $\forall_x \in L$, if $|x| \geq n$, then x can be decomposed into three strings $\exists_{u,v,w} \in \{ 0, 1\} ^{*}$. Where x = xyz. $|xy| \leq n, |y| > 0$ such that $\forall_k \in N, xy^k z \in L$.

We know that the length of L is $2 * |w|$. We will say the pumping length will be n so the language must be $w^n w^n$. We will split $w_1 w_2$ into $w_1 w_2 = xyz$ where $xy = w_1$ and $w_2 = z$. We know that y^i where y is some value $i > 0$. If $xy^0 z = w^{n-i} w^n$. This word should exist in the language L but is a contradiction because one w is greater than the other.

2. Prove that $L = \{ w \in \{ a, b\} ^{*} : |w|_a \neq |w|_b\}$ is not regular.

We will prove this by proof of contradition and assume that L is a regular language. So therefore for L, $\exists_n \in N$ such that $\forall_x \in L$, if $|x| \geq n$, then x can be decomposed into three strings $\exists_{u,v,w} \in \{ 0, 1\} ^{*}$. Where x = xyz. $|xy| \leq n, |y| > 0$ such that $\forall_k \in N, xy^k z \in L$.

We will say that $w = xy\prime z$ and that $y\prime = a^i b^i$. i is some natural number greater than 0. So we could say $w = xy\prime^1 z = b^t a^f b^g b^d$ where f+g = i and $t + i \leq n$ and $n \leq t + i + d$. We can also assume that $w = xyz$ where $y = a^i$ and i is some natural number greater than 0. So $xy^1 z = b^t a^i b^d$ where ba = xy, and z = b. $t + i \leq n$. In both cases k = 1 and both of their lengths are the same and they are part of the language L so therefore by contradiction L is not regular.