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 $\exists_{x,y,z} \in \{ 0, 1\} ^*$. Where x = xyz. $|xy| \leq n, |y| > 0$ such that $\forall_k \in N, xy^kz \in L$.

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 $i > 0$ and it represents elements from w_1. If $xy^0z = w^{n-i}w^n$. This word should exist in the language L but is a contradiction because one w is greater than the other. So therefore L is not regular.

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 $\exists_{x,y,z} \in \{ 0, 1\} ^*$. Where x = xyz. $|xy| \leq n, |y| > 0$ such that $\forall_k \in N, xy^kz \in L$.

Consider $a^n b^n$, this say that $x = a^i b^j$ for some i,j greater than 0. Then we will do $xy^2z = a^{i+n}b^{j+n}$. To be valid j and i need to be greater than 0 so either $a^{1+n}b^{2+n}$ or $a^{2+n}b^{1+n}$ are valid but one has a greater number of b's or a's for two strings that