**Project**

**Company name

Description automatically generated with low confidenceProblem**

For problem 1.47 from our textbook, we must prove that Y is not regular. We will analyze the problem and solution below.

**Proof by contradiction**

We will compute this solution by using a contradiction to prove Y is indeed not regular. Proof by contradiction is a strong technique which is often used for proving that a given language is not regular. If we are trying to prove irregularity of a language, we can do so by assuming that the given language is regular and apply pumping lemma on the language. After going through the possible ways of writing w = xyz we will try to derive a scenario where a contradiction where w ∈/ Y which will prove that the language cannot possible be a regular language.

**Proof**

Given∑ = {1, #} and Y = {w | w = x1#x2# ··· #xk for k ≥ 0, each xi ∈ 1∗ , and xi =/ xj for i =/ j}.

Assume Y is regular.

Let Y’ = Ȳ ∩ 1 ∗#1∗ , Then Y’ = {1^n#1^n : n ≥ 0}

We assume Y’ to be regular and k be the constant. Now we choose w = 1^k#1^k which is obviously in Y and satisfies the condition |w| >= k.

For every possible way of writing w = xyz such that |xy| <= k and |y| >= 1:

x = 1^r,   
y = 1^s,   
z = 1^(k-r-s)#1^k,  
where r + s <= k and k >= 1.

Take i = 0, so xy^iz = 1^(k-s)#1^k.  
Since s >= 1 it follows that w does not exist in (∈/) Y so a contradiction arises.   
Therefore, we have proven Y is not regular.