**Assignment 1:**

1. Let L = { w ∈ {0,1}\* | w does not contain the substring 101 }.  
   Can you construct a DFA for L with minimum states? Justify your state count.
2. A DFA M has 5 states. What is the maximum possible number of strings of length ≤ 3 that it does not accept over Σ = {0,1}?
3. Let L1 and L2 be regular languages. Is it always true that L1 − L2 is also regular? Prove with an example and construct FA for the difference.
4. Construct a regular expression for all strings over {a, b} such that every a is immediately followed by at least one b, but b’s can occur anywhere.
5. Consider L = { aⁿbᵐcⁿ | n, m ≥ 1 }.
   * Can this be accepted by a single-stack PDA?
   * If not, prove why and suggest an alternative model.

**Assignment 2:**

1. Design a Turing machine to delete every third symbol from the input string over Σ = {a, b}.  
   Example: Input = ababababa → Output = abababa
2. Is the language L = { ⟨M⟩ | M is a TM that accepts at least one input } decidable?  
   Prove with reasoning related to the Halting Problem.
3. Design a TM that checks whether a binary string is a palindrome.  
   (No extra tapes; use only one tape.)
4. Suppose we have a language L that is recognizable but not decidable.
   1. Can L's complement be recognizable?
   2. Give one real example and explain.
5. Prove that the language L = { ⟨M⟩ | M is a TM and M halts on input 000 } is undecidable, but semi-decidable.