Prove that each of the following languages is not regular.

1. \( \{ 0^{2n} \mid n \geq 0 \} \)

2. \( \{ 0^{2n+1} \mid n \geq 0 \} \)

3. \( \{ 0^{m+1} \mid m \neq 2n \} \)

4. Strings over \( \{0,1\} \) where the number of 0s is exactly twice the number of 1s.

5. Strings of properly nested parentheses (), brackets [], and braces {}. For example, the string ([]){} is in this language, but the string ([])] is not, because the left and right delimiters don't match.

Work on these later:

6. Strings of the form \( w_1 \# w_2 \# \cdots \# w_n \) for some \( n \geq 2 \), where each substring \( w_i \) is a string in \( \{0,1\}^* \), and some pair of substrings \( w_i \) and \( w_j \) are equal.

7. \( \{ 0^{n^2} \mid n \geq 0 \} \)

8. \( \{ w \in \{0,1\}^* \mid w \text{ is the binary representation of a perfect square} \} \)