

**BRAC UNIVERSITY**  
Merul Badda, Dhaka, Bangladesh  
**CSE331 : Automata and Computability**  
**Assignment 3**  
**Spring 2025**

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**1. Use the pumping lemma to show that the following languages are not regular:**

- A.  $L(M) \rightarrow \{0^{2n}1^n \mid n \geq 0\}$ , where  $\Sigma = \{0, 1\}$ .
- B.  $L(M) \rightarrow \{0^n1^m0^{f(n,m)} \mid n, m \geq 0\}$ , where  $f(n, m) = n * m$  and  $\Sigma = \{0, 1\}$ .
- C.  $L(M) \rightarrow \{0^n1^m \mid n > m\}$ , where  $\Sigma = \{0, 1\}$ .
- D.  $L(M) \rightarrow \{0^{n^2} \mid n \geq 0\}$ , where  $\Sigma = \{0, 1\}$ .
- E.  $L(M) \rightarrow \{w \mid w \text{ is not a palindrome}\}$ , where  $\Sigma = \{0, 1\}$ .

**2. Write a CFG for the following CFL:**

- A.  $L(M) \rightarrow \{0^n1^m \mid n, m \geq 0 \text{ and } 2n = 3m\}$ , where  $\Sigma = \{0, 1\}$
- B.  $L(M) \rightarrow \{0^n1^m2^m3^n \mid n, m > 0\}$ , where  $\Sigma = \{0, 1, 2, 3\}$
- C.  $L(M) \rightarrow \{w = 0^i1^j2^k \mid i, j, k \geq 0 \text{ and } j < i + k\}$ , where  $\Sigma = \{0, 1, 2\}$
- D.  $L(M) \rightarrow \{w_1\#w_2 \mid \text{the number of } 00 \text{ in } w_1 \text{ is equal to the number of } 11 \text{ in } w_2\}$ , where  $\Sigma = \{0, 1\}$
- E.  $L(M) \rightarrow \{w\#x \mid w^R \text{ is a substring of } x\}$ , where  $\Sigma = \{0, 1\}$