--Question Starting--
3. Given the regular language L defined over alphabet ? = {a, b} such that L = {a^n b^n | n ? 0}, which of the following statements correctly describes its properties?
Statement I: L is a regular language because it can be represented by a regular expression.
Statement II: L is non-regular and can be proven so using the pumping lemma for regular languages.
In the context of the above, select the correct option:
(1) Both Statement I and Statement II are correct
(2) Both Statement I and Statement II are incorrect
(3) Statement I is correct but Statement II is incorrect
(4) Statement I is incorrect but Statement II is correct
Answer Key: 4
Solution:
? Statement I (Incorrect): The language L = {a^n b^n | n ? 0} is a classic context-free language that requires matching numbers of a's and b's. It cannot be expressed by any regular expression because regular languages lack memory to count and compare.
? Statement II (Correct): The pumping lemma for regular languages can be used to show that L is non-regular. For instance, assuming L is regular, pumping a string a^n b^n would lead to a contradiction, confirming its non-regularity.
Hence, Option (4) is the right answer.