

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR  
Computer Science and Engineering  
Foundations of Computing Science (CS60005)  
Class Test – I (Autumn)

Place: CSE-107

Date: Wed, Sep 05, 2018

Time: 8:15am-9:15am (FN)

Students: 77

Marks: 30

**Answer ALL the questions (following question specific instructions)**

- Q1: Choose the last non-zero digit from your roll number and any other non-zero digit, excluding the first digit to ensure that the resulting number is not a prime number. Construct the lattice of divisors for the number. 5
- Q2: Prove that  $x^{2n+1} + y^{2n+1}$  is divisible by  $x + y$  for all  $n \geq 0$ . 5
- Q3: Consider the language  $\{w \mid w \text{ is any string not in } (ab^+)^*\}$
- (a) Construct the DFA to recognise this language 5
  - (b) Construct the GNFA corresponding to the constructed DFA to yield the RE for this language 5
- Q4: Let  $L = \{a^i b^j \mid i, j \geq 0 \text{ and } 2i \neq j\}$ . Show that  $L$  is a context free language. 5
- Q5: Prove that the subset of a context free language with strings starting and ending in the same symbol is context free. *Hint: Utilize closure properties of CFLs and RLs.* 5