CS30053 Foundations of Computing, Autumn 2005

Class test 1

Total marks: 20 | September 08, 2005 | **Duration:** 1 hour

Name: _____ **Roll No:** _____

Answer all questions in the respective spaces provided.
Use extra sheets for rough work. Any such extra sheet will not be corrected.

1. Design a finite automaton (deterministic or nondeterministic) to recognize the language **(5)**

$$\{\alpha \in \{a, b\}^* \mid \text{the number of } a\text{'s in } \alpha \text{ minus the number of } b\text{'s in } \alpha \text{ is not a multiple of } 3\}\,.$$

2. Design a finite automaton (deterministic or nondeterministic) to recognize the set of strings over the alphabet $\{a, b, c\}$, generated by the regular expression $(aa \cup b)c(aa \cup b)^*$. **(5)**

3. Consider the language

$$L = \{a^i b^j c^k \in \{a, b, c\}^* \mid i, j, k \geqslant 0 \text{ and } i + j = k\}.$$

(a) Prove that L is not regular. **(5)**

(b) Design a context-free grammar G with $\mathcal{L}(G) = L$. **(5)**