G 1701 (2 pages) Reg. No .....

Name .....

B.Tech. DEGREE EXAMINATION, JUNE/JULY 2006

Seventh Semester

Branch — Computer Science and Engineering

THEORY OF COMPUTATION (R)

(2002 Admissions—Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Define a partial recursive function.
2. What is an NP problem ? Give an example.
3. Differentiate between deterministic and non-deterministic algorithms.
4. Show that for any two sets A and B, $A - (A \cap B) - A - B$.
5. What is a context-free language. Explain with an example.
6. Write a short notes on Halting problem of turing machine.
7. Construct a DFA for $(a/b)^* \; a \; b \; b$.
8. Define a PDA.
9. Explain the Church's hypothesis.
10. Define a NDFA.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (a) (i) Show that the set z of integers is denumerable. (6 marks)

(ii) Define context-sensitive and regular grammers. Give examples. (6 marks)

Or

(b) (i) Find a function $f(x)$ such that $f(2) = 3, f(4) = 5, f(7) = 2$ and $f(x)$. Assume any arbitrary value for other arguments. Show that $f(x)$ is primitive recursive. (6 marks)

(ii) For any three sets A, B and C, show that $A \times (B \cup C) = (A \times B) \cup (A \times C)$. (6 marks)

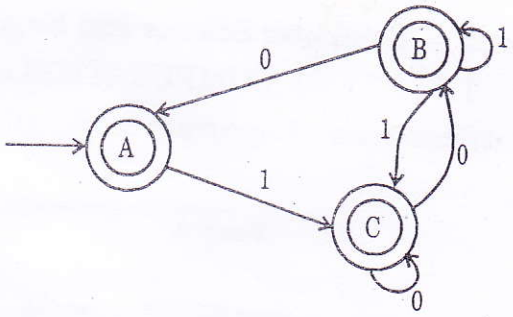
12. (a) For the regular expression $a^* \; (a/b)^* \; b$ draw the NFA. Obtain DFA from NFA.

Or

Turn over

(b) (i) Design an algorithm for minimizing the states of DFA. (8 marks)

(ii) Construct the regular expression equivalent to the state diagram given below :



(4 marks)

13. (a) Construct a PDA that accepts the language $L = \{a^n b\, a^m / n, m \geq 1\}$ by empty stack.

Or

(b) (i) Given the CFG $(\{S\}, \{a, b\}, \{S \rightarrow S\,a\,S, S \rightarrow b\}, S)$ draw the derivation tree for the string $b\,a\,b\,a\,b\,a\,b$.

(4 marks)

(ii) Give a CFG which generates the language $L = \{a^n b^n c^n / n \geq 1\}$. (8 marks)

14. (a) Design a Turing machine to recognize the language $L = \{0^n\ 1^n\ 0^n / n \geq 1\}$.

Or

(b) (i) Construct a turing machine that will compute $f(x, y) = x + y$. (6 marks)

(ii) Write a note on Universal Turing machines. (6 marks)

15. (a) Discuss any *two* NP-hard graph problems in detail.

Or

(b) (i) What are NP complete problems ? Give two examples. (6 marks)

(ii) Briefly explain the satisfiability problem. Is it an NP problem ? (6 marks)

[5 × 12 = 60 marks]