

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, JANUARY 2009

Computer Science (Main)

CS 104—THEORETICAL COMPUTER SCIENCE

(2005 Admission)

Maximum : 80 Marks

Time : Three Hours

Part A

Answer any five questions.

1. Find the DFA that accepts (i)  $a^*b + b^*a$  ; (ii) set of strings over  $\{a, b\}$  beginning and ending with a.
2. Describe the procedure of finding FA for given regular expression.
3. Outline the procedure of converting the set of productions of a CFG to CNF. Give an example.
4. State pumping lemma for CFG and show that  $\{a^i / i \geq 1\}$  is not CFL.
5. Find a TM to accept  $\{0^n \mid n \geq 1\}$
6. State and informally prove Chomsky's hierarchy.
7. Find the conjunctive normal form of  $(P \vee Q) \wedge (P \wedge R)$ .

(5 x 8 = 40 marks)

Part B

Answer any four questions.

8. Find the DFA equivalent to the given NFA with E :

Input	$\epsilon$	0	1
State			
A (starting)	{B}	{A}	$\Phi$
B	{D}	{C}	$\Phi$
C	$\Phi$	$\Phi$	{B}
D (final)	$\Phi$	{D}	

Turn over

9. (a) For the FA below find minimum state DFA :

State	Input a	Input b
1 (starting)	{2}	$\Phi$
2	{1}	{3}
3 (final)	{2}	{4}
4	{4}	{5}

cm  
 30  
 30  
 10

- (b) State pumping lemma for regular sets and list the closure properties of regular sets.
10. Construct a PDA to accept  $\{a^i b^j \mid i > j\}$  by emptying stack contents. Also construct a final state PDA accepting the same set of strings.
11. (a) Find TM to accept  $\{a^n b^n c^n \mid n \geq 1\}$
- (b) Design a TM to add two integers.
12. Discuss P, NP, NP-complete problems giving *one* example for each.
13. (a) Explain any *one* method to making inferences in predicate calculus.
- (b) Is the following sentences true ? If philosophers are not money minded and some money minded persons are not clever, then there are persons who are neither philosophers nor money minded.

(4 x 10 = 40 marks)