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Printed Pages : 4

TCS – 405

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1071 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. IV) EXAMINATION, 2006-07

THEORY OF AUTOMATA & FORMAL LANGUAGES

Time : 3 Hours] *[Total Marks : 100*

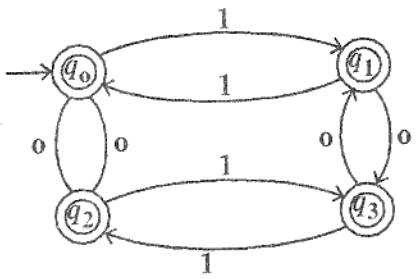
Note : *(1) Attempt **all** questions.*
*(2) All questions carry **equal** marks.*

1 Attempt any **two** parts of the following :

(a) (i) Find the transitive closure R^+ and reflexive and transitive closure R^* of the relation- 4

$$R = \{(1,2),\ (2,3),(3,4),(5,4)\}$$

(ii) Consider the following transition diagram- 6



Test whether the string 110101 is accepted by the finite automata represented by above transition diagram. Show the entire sequence of states traversed.

(b) Give DFA accepting the following languages over the alphabet $\{0, 1\}$ - **10**

(i) The set of all strings with three consecutive zeros.

(ii) The set of all strings such that every block of 05 consecutive symbols contains at least two zeros.

(c) Find the equivalence partition and corresponding reduced machine in standard form, for the following machine - **10**

PS	*NS, Z*	
	$X = 0$	$X = 1$
A	F, 0	B, 1
B	G, 0	A, 1
C	B, 0	C, 1
D	C, 0	B, 1
E	D, 0	A, 1
F	E, 1	F, 1
G	E, 1	G, 1

where, *PS* = Present State, *NS* = Next State
Z = Output, *X* = *I/P*

2 Attempt any **two** questions :

(a) Construct DFA equivalent to the NFA- $(\{p, q, r, s\}, \{0, 1\}, \delta, p, \{s\})$, where δ is given by **10**

	0	1
p	*p,q*	*p*
q	*r*	*r*
r	*s*	–
s	*s*	*s*

(b) Construct NFA for $(a/b)^+$ and derive DFA through subset construction algorithm. **10**

(c) Prove or disprove the following for regular expressions r, s and t **10**

(i) $(r+s)^* = r^* + s^*$

(ii) $s(rs+s)^* r = rr^* s(rr^* s)^*$

3 Attempt any **four** questions :

(a) Construct finite automata equivalent to following regular expression - **5**

$$10+(0+11)0^*1$$

(b) Write regular expression for the following language over the alphabet $\{0, 1\}$ - **5**

"The set of all strings not containing 101 as a substring."

(c) Explain the procedure to convent a Moore machine into its corresponding Mealy machine, with the help of an example. **5**

(d) Find parse tree for the expression abbcde considering the productions - **5**

$S \rightarrow a\,Ac\,Be$

$A \rightarrow Ab$

$A \rightarrow b$

$B \rightarrow d$

(e) What is an ambiguous grammar ? Explain with example. **5**

(f) Consider the grammar $(\{S, A, B\}, \{a, b\}, P, S)$ that has the productions - 5

$S \rightarrow bA/aB$

$A \rightarrow bAA/aS/a$

$B \rightarrow aBB/bS/b$

Find an equivalent grammar in CNF.

4 Attempt any **two** questions :

(a) Define concept and working of a PDA. 10

(b) Construct a PDA equivalent to the following grammar- 10

$S \rightarrow aAA$

$A \rightarrow aS/bS/a$

(c) Construct a PDA accepting the language- 10

$\{a^i\ b^j\ c^k / i \neq j \ \ or \ \ j \neq k\}$

5 Attempt any **four** questions :

(a) Define the basic model of a Turing machine. 5

(b) Explain the techniques for Turing machines construction. 5

(c) Explain Church's thesis. 5

(d) Design Turing machine to compute the function $f(n) = n^2$ 5

(e) Design Turing machine to recognize the language- "The set of strings with an equal no. of 0's and 1's." 5

(f) Give recursive definitions for : $n + m$. 5