Code No.V3127/R07

Set No.1

III B.Tech I Semester Regular Examinations November, 2010

FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science & Engineering)

Time: 3 hours **Max.Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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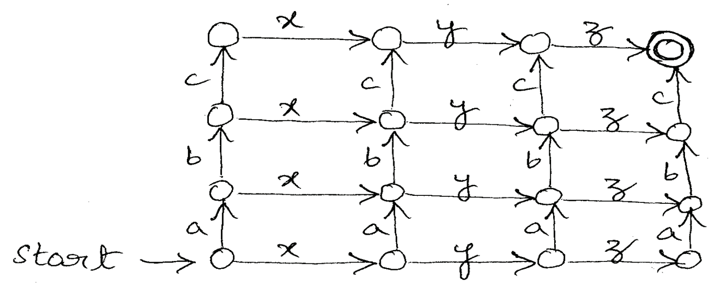
(1). (a) Compare NFA and DFA with the help of suitable examples.

(b) Construct a DFA that accepts an identifier of a 'C' programming language.

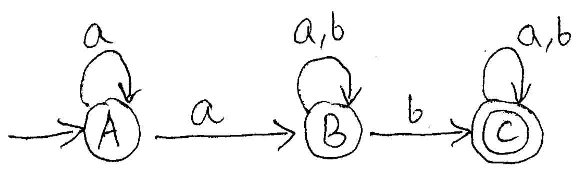
(c) Consider the following finite automaton that recognizes a set of strings of length 6.



What is the total number of strings in the set? Explain. [5+5+6]

(2). (a) Design a DFA over $\Sigma = \{0, 1\}$ accepting all strings of even number of decimal numbers in binary.

(b) Construct a DFA equivalent to the following NFA diagram: [8 + 8]



(3). (a) When are two regular expressions said to be equivalent? Obtain the regular expression represented by the regular set: {0, 1, 00, 01, 000, 001, 0000, 0001, … }

(b) Prove the following regular expression identities: [8 + 8]

(i) $1 + (\in + 0)(\in + 0)^* 1 = 0^* 1$

(ii) $\in + 1^* (011)^* (1^* (011)^*)^* = (1 + 011)^*$

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(4). (a) Obtain the regular expression generated by the following grammar, G:
G = ({S, W, X, Y, Z}, {x, y, z}, P, S), where P is defined by:

$S \to WZ; \quad W \to X|Y; \quad X \to x|xX; \quad Y \to y|yY; \quad Z \to z|zZ$

(b) Consider the following context free grammar: [8 + 8]

$E \longrightarrow I \mid E+E \mid E*E \mid (E)$

$I \longrightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$

Find the leftmost derivation, rightmost derivation, and parse tree for the string: a*(a+b00).

(5). (a) State and prove the pumping lemma for context free languages.

(b) Find the Greibach normal form of the following grammar: [8 + 8]

$E \longrightarrow E+T \mid T$
$T \longrightarrow T*F \mid F$
$F \longrightarrow (E) \mid a$

(6). Let M = ({q_0, q_1}, {a, b}, {Z_0, Z}, δ, q_0, Z_0, ⊄) be a push down automata (PDA) and δ is defined by:

$\delta(q_0, b, Z_0) = \{(q_0, Z Z_0)\}$ $\quad$ $\delta(q_0, \varepsilon, Z_0) = \{(q_0, \varepsilon)\}$

$\delta(q_0, b, Z) = \{(q_0, Z Z)\}$ $\quad$ $\delta(q_0, a, Z) = \{(q_1, Z)\}$

$\delta(q_1, b, Z) = \{(q_1, \varepsilon)\}$ $\quad$ $\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$

(i) Find the language accepted by the PDA, M by empty store.

(ii) Construct a context free grammar (CFG), G that accepts null store, N (M) [8 + 8]

(7). (a) Consider the following transition table (States versus Tape symbols) of a Turing Machine, M:

	(	*	)	B
q_1	q_1, (, R	q_1, *, R	q_2, *, L	q_3, B, L
q_2	q_1, *, R	q_2, *, L	q_2,), L	Halt
q_3	Halt	q_3, *, L	q_3,), L	Halt

If the initial Instantaneous Description (ID) is: q_1 (( ) B, then what is the final ID?

(b) Design a Turing Machine (TM) that accepts the language, L = { $0^n 1^n 0^n \mid n \geq 1$ } [8 + 8]

(8). (a) State and explain the undecidability of post correspondence problem

(b) Explain, in detail, *NP* Complete and *NP* hard problems with examples. [8 + 8]

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Set No.2

Code No.V3127/R07

III B.Tech I Semester Regular Examinations November, 2010

FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science & Engineering)

Time: 3 hours **Max.Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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(1). (a) Explain NFA mathematically with an example.

(b) Construct a DFA that accepts an identifier of a 'C' programming language.

(c) Obtain the number of states in the minimized machine of the following state table of FSM: [5 + 5 + 6]

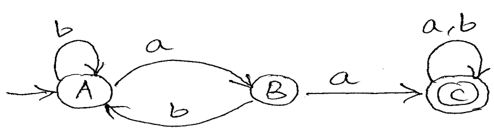
PS	NS, OUTPUT	
	I/P=0	I/P=1
A	D, 0	B, 1
B	A, 0	C, 1
C	A, 0	B, 1
D	A, 1	C, 1

(2). (a) Design a DFA that accepts the language over $\Sigma = \{0, 1\}$ of all strings that contain neither the sub-string 00 nor the sub-string 11.

(b) Design a Moore machine and Mealy machine that accepts strings over $\Sigma = \{0, 1\}$ where, if the input ends in 001, output a A; if the input ends in 100 , output a B; else output a C. [8 + 8]

(3). (a) When are two regular expressions said to be equivalent? Explain.

(b) Find the regular expression for the following finite automaton:



(c) Show that the following regular expression identities are equivalent:

(i) $r^+ = r^* r^+$ (ii) $(r + s)^* = (r + s^*)^*$ [5 + 5 + 6]

(4). (a) Consider the following context free grammar:

E → I | E+E | E*E | (E)

I → a | b | Ia | Ib | I0 | I1

Find the leftmost derivation, rightmost derivation, and parse tree for the string: a*(a+b00).

(b) Write a context free grammar for the while statement in 'C' language. [8 + 8]

(5). (a) Consider the following context free grammar, G:

$S \rightarrow ABAC$
$A \rightarrow aA \mid \in$
$B \rightarrow bB \mid \in$
$C \rightarrow d$

Convert the **G** equivalent to **G′** that has: no null productions, and no unit productions one after the other.

(b) Find the Greibach normal form of the following grammar: [8 + 8]

$S \rightarrow AA \mid x$
$A \rightarrow SS \mid y$

(6). Let M = ({q_0, q_1}, {a, b}, {Z_0, Z}, δ, q_0, Z_0, ¢) be a push down automata (PDA) and δ is defined by:

$\delta(q_0, b, Z_0) = \{(q_0, Z Z_0)\}$ $\delta(q_0, \varepsilon, Z_0) = \{(q_0, \varepsilon)\}$

$\delta(q_0, b, Z) = \{(q_0, Z Z)\}$ $\delta(q_0, a, Z) = \{(q_1, Z)\}$

$\delta(q_1, b, Z) = \{(q_1, \varepsilon)\}$ $\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$

(i) Find the language accepted by the PDA, M by empty store.

(ii) Construct a context free grammar (CFG), G that accepts null store, N(M) [8 + 8]

(7). (a) Explain, briefly, about the different types of Turing Machines.

(b) Design a Turing Machine (TM) that accepts the language, $L = \{ 0^n1^n0^n \mid n \geq 1 \}$ [8 + 8]

(8). (a) State and explain the undecidability of post correspondence problem

(b) What do you meant by decidable and undecidable problems? Explain, in detail, P and NP problems with suitable examples. [8 + 8]

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Set No.3

Code No.V3127/R07

III B.Tech I Semester Regular Examinations November, 2010

FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science & Engineering)

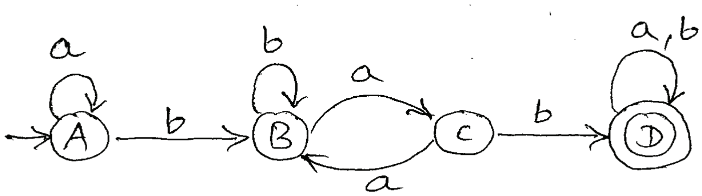
Time: 3 hours **Max.Marks: 80**

Answer any FIVE questions
All questions carry equal marks
*****

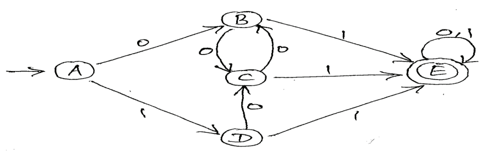
(1). (a) What are the elements of finite automata? Explain mathematically.

(b) Compare NFA and DFA with the help of suitable examples.

(c) What is the language accepted by the following finite automaton? [5 + 5 + 6]



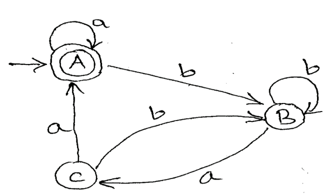
(2). (a) Construct a minimal state finite automaton to the following state diagram:



(b) Design a Moore machine and Mealy machine that accepts strings over $\sum = \{0, 1\}$ where, if the input ends in 001, output a A; if the input ends in 100 , output a B; else output a C.[8 + 8]

(3). (a) Construct an NFA and DFA for the regular expression: (0 + 1)*(00 + 11) 110.

(b) Find the regular expression for the following finite automaton: [8 + 8]



(4). (a) Give the context free grammar that generates the set $\{0^n 1^n \mid n \geq 1\}$

(b) Consider the following context free grammar: $E \rightarrow +EE \mid *EE \mid -EE \mid x \mid y$

Find the leftmost derivation, rightmost derivation, and parse tree for the string: $+ * - x y x y$
[8 + 8]

(5). (a) Consider the following context free grammar, G:

$S \rightarrow ABAC$
$A \rightarrow aA \mid \in$
$B \rightarrow bB \mid \in$
$C \rightarrow d$

Convert the **G** equivalent to **G′** that has: no null productions, and no unit productions one after the other.

(b) Find the Greibach normal form of the following grammar: [8 + 8]

$E \rightarrow E+T \mid T$
$T \rightarrow T*F \mid F$
$F \rightarrow (E) \mid a$

(6). Let M = ({q_0, q_1}, {a, b}, {Z_0, Z}, δ, q_0, Z_0, ¢) be a push down automata (PDA) and δ is defined by:

$\delta(q_0, b, Z_0) = \{(q_0, Z Z_0)\}$ $\delta(q_0, \varepsilon, Z_0) = \{(q_0, \varepsilon)\}$

$\delta(q_0, b, Z) = \{(q_0, Z Z)\}$ $\delta(q_0, a, Z) = \{(q_1, Z)\}$

$\delta(q_1, b, Z) = \{(q_1, \varepsilon)\}$ $\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$

(i) Find the language accepted by the PDA, M by empty store.

(ii) Construct a context free grammar (CFG), G that accepts null store, N(M) [8 + 8]

(7). (a) Consider the following transition table (States versus Tape symbols) of a Turing Machine, M:

	0	1	B
→q_1	q_1, 0, R	-	q_2, 1, L
q_2	q_2, 0, L	q_2, 1, L	q_3, B, R
q_3	q_4, B, R	q_5, B, R	-
q_4	q_4, 0, R	q_4, 1, R	q_5, 0, R
(q_5)	-	-	q_2, 0, L

Find the computation sequence of the input string: 00B

(b) Design a Turing Machine, M that accepts the set of strings with an equal number of 0's and 1's

[8 + 8]

(8). (a) What is a universal Turing machine? Explain Turing reducibility.

(b) Construct the LR(0) parser for the following grammar: [8 + 8]

$E' \rightarrow E$

$E \rightarrow E + n \mid n$

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Set No.4

Code No.V3127/R07

III B.Tech I Semester Regular Examinations November, 2010

FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science & Engineering)

Time: 3 hours **Max.Marks: 80**

Answer any FIVE questions
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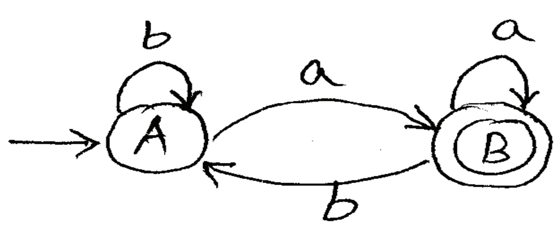
*****

(1). Give a finite state diagram that accepts all the floating-point numbers. [16]

(2). (a) Design a DFA that accepts the language over the alphabet, $\Sigma = \{0, 1, 2\}$ where the decimal equivalent of the language is divisible *not* by 3.

(b) Design a Moore machine and Mealy machine that accepts strings over $\Sigma = \{0, 1\}$ where, if the input ends in 001, output a A; if the input ends in 100 , output a B; else output a C. [8 + 8]

(3). (a) Show that the simplified regular expression recognized by the following DFA is the set of all strings of a's and b's that end with letter a.



(b) Show that the following regular expression identities are equivalent: [8 + 8]

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

(4). (a) Construct a context free grammar for generating the balanced parentheses, like ( ), [ ], [( ) ( )], ([ ]), etc. and find the moves of the grammar to derive the string: ([( )] ( ))

(b) Draw the parse tree for the production grammar: $S \rightarrow (S) \mid S \supset S \mid \sim S \mid i \mid j$, generating the symbolic formula: $(\sim \sim i \supset (i \supset \sim \sim j))$. [8 + 8]

(5). (a) State and prove the pumping lemma for context free languages.

(b) Find the Greibach normal form of the following grammar: [8 + 8]

$S \rightarrow AA \mid x$
$A \rightarrow SS \mid y$

(6). Let M = ({q_0, q_1}, {a, b}, {Z_0, Z}, δ, q_0, Z_0, ¢) be a push down automata (PDA) and δ is defined by:

$\delta(q_0, b, Z_0) = \{(q_0, Z Z_0)\}$ $\delta(q_0, \varepsilon, Z_0) = \{(q_0, \varepsilon)\}$

$\delta(q_0, b, Z) = \{(q_0, Z Z)\}$ $\delta(q_0, a, Z) = \{(q_1, Z)\}$

$\delta(q_1, b, Z) = \{(q_1, \varepsilon)\}$ $\delta(q_1, a, Z_0) = \{(q_0, Z_0)\}$

(i) Find the language accepted by the PDA, M by empty store.

(ii) Construct a context free grammar (CFG), G that accepts null store, N(M) [8 + 8]

(7). (a) State and prove the halting problem of Turing Machine (TM).

(b) Design a Turing Machine, M that accepts a palindrome consisting of 0's and 1's of any length.

[8 + 8]

(8). Consider the following grammar:

$E' \rightarrow E$
$E \rightarrow E + n \mid n$

(i) Construct the LR (0) parser

(ii) Find the moves made by the LR(0) parser on the input string: $n + n + n$ [8 + 8]

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