ROLL NO. _____

Code: AC68 Subject: FINITE AUTOMATA & FORMULA LANGUAGES

AMIETE – CS (NEW SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. The language constructs which are most useful in describing nested structures such as balanced parenthesis.

(A) Regular expression **(B)** Context-free grammars
(C) Non-context free grammar **(D)** Recursively enumerable language

b. Universal Turing Machine influenced the concept of

(A) stored program computers
(B) interpretive implementation of programming language.
(C) Computability.
(D) All of these.

c. The statement "A Turing Machine can't solve halting problem" is

(A) true **(B)** false
(C) still a open question **(D)** all of these

d. For which of the following applications regular expression can't be used?

(A) Designing compilers **(B)** Developing text editors
(C) Simulating sequential Circuits **(D)** All of these

e. A string of terminals that can be generated by the following CFG :

$S \rightarrow AB$

$A \rightarrow aA/bB/a$

$B \rightarrow Ba/Bb/a$

(A) has atleast one b. **(B)** should end in an 'a'.
(C) has no consecutive a's or b's. **(D)** has atleast two a's

f. Recursive languages are

(A) closed under intersection **(B)** recursively enumerable
(C) closed under complementation **(D)** All of these

g. What is the highest type number according to Chomskey hierarchy that can be applied to the grammar with production? $S \rightarrow Aa, A \rightarrow Ba, B \rightarrow abc$

(A) Type 0 **(B)** Type 1
(C) Type 2 **(D)** Type 3

h. Which of the following is a valid set of productions?

(A) $E \rightarrow E + T/T$
$T \rightarrow E$

(B) $E \rightarrow E + E$

(C) $E \rightarrow T$
$T \rightarrow T+T/E$

(D) $E \rightarrow E + T/T$
$T \rightarrow E/id$

i. The productions $E \rightarrow E + E$, $E \rightarrow E - E$, $E \rightarrow E * E$, $E \rightarrow E/E$, $E \rightarrow id$.

(A) generate an inherently ambiguous grammar
(B) generate an ambiguous grammar but not inherently so.
(C) are unambiguous.
(D) can generate all possible fixed length valid computation for carrying out addition, subtraction, multiplication, and division which can be expressed in one expression.

j. The major difference between a Moore and Mealy machine is that

(A) the output of the former depends on the present state and present input.
(B) the output of the former depends only on the present state.
(C) the output of the former depends only on the present input.
(D) all of these.

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. List the important aspects of automata theory? **(8)**

b. Discuss the pigeonhole principle with example? **(8)**

Q.3 a. Design a NFA for the language $L = (ab \cup aba)^*$. **(8)**

b. Design a DFA for the language.
$L = \{w : n_a(w) \geq 1, w \in (a, b)^*\}$. **(8)**

Q.4 a. Write a regular expression for the language
$L = \{w \in \{0, 1\}^* : w$ has no pair of consecutive zeros$\}$. **(8)**

b. Find a regular expression for transition diagram given in Fig.1 below: **(8)**

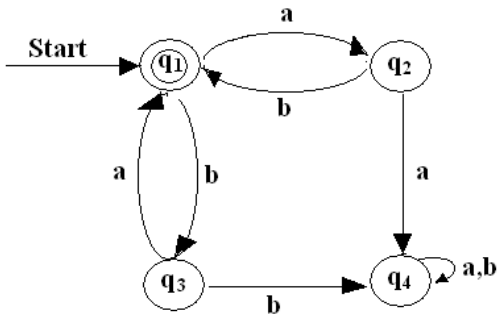

Fig.1

Q.5 a. Prove that language L = $\{a^n b^n$ for n = 0, 1, 2, 3, … $\}$ is not regular. **(8)**

b. Let $\sum = \{0, 1\}$ and $\sum' = \{0, 1, 2\}$ and defined h by

$h(0) = 01$

$h(1) = 112$

Find $h(010)$ and homomorphic image of L = {00, 010}. **(8)**

Q.6 a. Write a Context Free Grammar, that generates string of balanced parenthesis. **(8)**

b. Construct a PDA for the regular expression
r $= 0^* 1^+$. **(8)**

Q.7 a. Change the following grammar in to CNF

$S \rightarrow 1A/0B$

$A \rightarrow 1AA/0S/0$

$B \rightarrow 0BB/1$ **(8)**

b. Prove that language L = $\{a^n b^n c^n \mid n \geq 0\}$ is not context-free language. **(8)**

Q.8 a. Design a Turing Machine that recognizes the language consisting of all strings of even length over alphabet {a, b}. **(8)**

b. Explain the concept of extension of Turing Machine. **(8)**

Q.9 a. Let $\sum = \{0, 1\}$. Let X and Y be lists of three strings each, defined as follows:

	List X	List Y
i	X_i	Y_i
1	1	111
2	10111	10
3	10	0

Show that in this case, a Post Correspondence Problem (PCP) has a solution. **(8)**

b. Prove that the union of two recursively enumerable languages is recursively enumerable. **(8)**