ROLL NO. _____

Code: AC68 Subject: FINITE AUTOMATA & FORMULA LA[illegible]S

AMIETE – CS

Time: 3 Hours **JUNE 2013** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **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 grammar with production rules

$\{S \longrightarrow aab / bac / ab$

$S \longrightarrow abb / ab$

$S \longrightarrow aS / b$

$B \longrightarrow bab / b\}$ is

(A) CFG **(B)** Regular
(C) Context Sensitive **(D)** None of these

b. Which of the following is not regular:

(A) String of 0's whose length is a perfect square
(B) Set of all palindromones made up of 0's and l's
(C) Strings of 0's, whose length is a prime number
(D) All of these

c. The recognizing capability of Nondeterministic FSM and corresponding deterministic FSM

(A) may be different **(B)** must be different
(C) must be same **(D)** none of these

d. In context free languages, state the size of parse tree, if the length of longest path is n

(A) 2^{n-1} **(B)** 2^n
(C) n **(D)** none of these

e. Which of the following pairs of regular expressions are equivalent?

(A) $1(01)^*$ and $(10)^*$ **(B)** $y(yy)^*$ and $(yy)^* y$
(C) $y+$ and $y^* y+$ **(D)** All of these

f. Context free Grammar is not closed under

(A) Union **(B)** Kleen star
(C) Complementations **(D)** Concatenation

g. The set $A = \{a^n b^n a^n / n = 1,2,3....\}$ is an example of a grammar that is

(A) Regular **(B)** Context free
(C) Context Sensitive **(D)** None of these

h. Let G= {s},{a, b}, $\{S \to GS|b, S\}$ find language generated by G

(A) L(G) = ϕ **(B)** L(G) = $a^n b$

(C) L(G) = a^* **(D)** L(G) = $a^n b^{a^n}$

i. L ={ $a^p | P$ is a prime} is

(A) Regular **(B)** Not a regular
(C) Accepted by DFA **(D)** Accepted by PDA

j. Grammar $S \to aAb$, $A \to aAb \mid a$ is in

(A) L R(1) not in LR(0) **(B)** both LR(0) and LR(1)
(C) LR(0) but not in LR(1) **(D)** neither in LR(0) not in LR(1)

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

Q.2 a. Use mathematical induction to prove that for all positive integers n, $n(n^2 + 5)$ is an integer multiple of 6. **(8)**

b. Define the terms - alphabet, power of alphabet, string and language. Provide one example for each. **(8)**

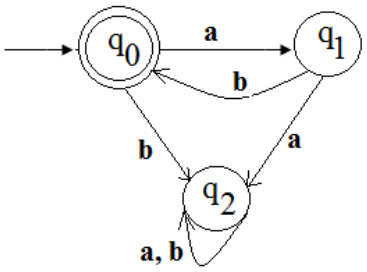
Q.3 a. For the following NFA, find the equivalent DFA. **(8)**

	0	1
$\to q_0$	$\{q_0, q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_2\}$
q_2	$\{q_3\}$	$\{q_3\}$
q_3	ϕ	ϕ

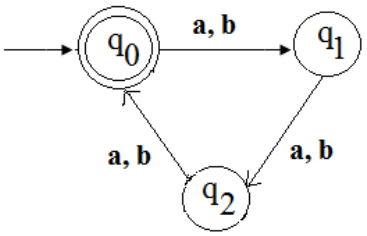
b. Write regular expression for the language defined over alphabet {a, b} as "The set of strings having at most one pair of consecutive a's and at most one pair of consecutive b's. **(8)**

Q.4 a. Describe the languages accepted by the following DFAs **(8)**

(i)



(ii)



b. Show that concatenation of two regular expression is a regular expression. **(8)**

Q.5 a. Prove following is not a regular language: **(8)**

$L = \{xx^R \mid x \in \{0,1\}^+\}$

b. If L is a Regular language then show that reverse of L i.e. L^R is also regular. **(8)**

Q.6 a. Let $L = \{a^n b^n c^m d^m \mid n, m \geq 1\}$. Draw a PDA that accepts L. **(8)**

b. Define a Context Free Grammar that generates the language: **(8)**

$L = \{a^i b^j c^k d^\ell \mid i, j, k, \ell \geq 1, i = \ell, j = k\}$ Draw a PDA that accepts L.

Q.7 a. Prove that the following language is not context free, **(8)**

$L_1 = \{a^p \mid p \text{ is a prime}\}$

b. What is Chomsky Normal form? Explain how a grammar can be put in CNF. Use an example to illustrate. **(8)**

Q.8 a. Consider the following TM M' with transitions as follows: **(8)**

$\delta(q_0,1) = (q_1,0,R)$

$\delta(q_1,1) = (q_1,1,R)$

$\delta(q_1,0) = (q_2,1,R)$

$\delta(q_2,0) = (q_3,0,L)$

$\delta(q_3,0) = (q_0,0,R)$

$\delta(q_3,1) = (q_3,1,L)$

q_0 is the initial state and 0 is taken as blank symbol. Trace the sequence of moves when the machine scan starts on ...00 1111 000 11 00...

b. Construct a TM with three character 0, 1, and # which locates a '1'under the following conditions. There is only one # on the tape and somewhere to the right of it is a 'l'. The rest of the tape is blank. The head starts at or to the left of the #. When the TM halts, the tape is unchanged and head stops at the 'l'. Zero is taken as the blank symbol. **(8)**

Q.9 a. Define a Recursively Enumerable language. Give an example of it. Give an example of a language that is not recursively enumerable. **(8)**

b. Show that the following problem is undecidable. **(8)**
"Given x_1, x_2 and x_3 determine whether $f(x_1) = \pi^2(x_2, x_3)$, where f is a fixed non total recursive function and π^2 is cantor numbering function".