Printed Pages : CS404

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

[redacted] **Roll No.**

B.TECH

Theory Examination (Semester-IV) 2015-16

THEORY OF COMPUTATION

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

1.Attempt all parts. All parts carry **equal** marks. Write answer of each part in short**. (2 x 10 =20)**

a) What is the purpose of Theory of Computation?

b) Differentiate between Theory of Computation and Theory of Computability.

c) If n is an odd positive integer, then n^2 is odd as well.

d) What is Deterministic Finite Automata?

e) Differentiate between DFA and NFA.

f) Define Equivalence of regular expressions.

g) What are Pumping Lemma for Regular Languages?

h) Define CNF.

i) What is multi-head turing machine?

j) Enlist the properties of Recursive Enumerable Language.

SECTION-B

2. Attempt any **five** questions from this section. **(10 x 5 = 50)**

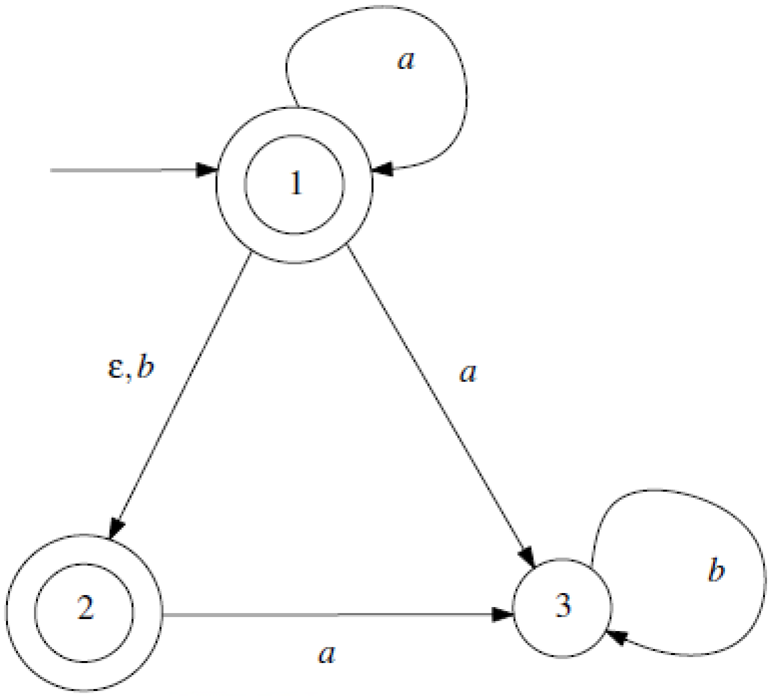
(a) (i) Prove that

$$\sum_{i=1}^{n} \frac{1}{i^2} < 2 - 1/n,$$

For every integer $n \geq 2$.

(ii) Prove that in any set of n+1 numbers from { 1, 2, ………., 2n}, there are always two numbers such that one divides the other.

(b) Convert the following NFA to an equivalent DFA.



(c) Let A and B be two regular languages over the same alphabet ∑. Prove that the difference of A and B i.e., the language

$$A \setminus B = \{w : w \in A \text{ and } w \notin B\}$$

is a regular language.

(d) Write a regular expression for the following language: The set of all strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's.

(e) Explain with example multitape turing machine.

(f) Construct a Turing machine with one tape that receives as input a nonnegative integer x and returns as output the integer x + 1. Integers are represented as binary strings

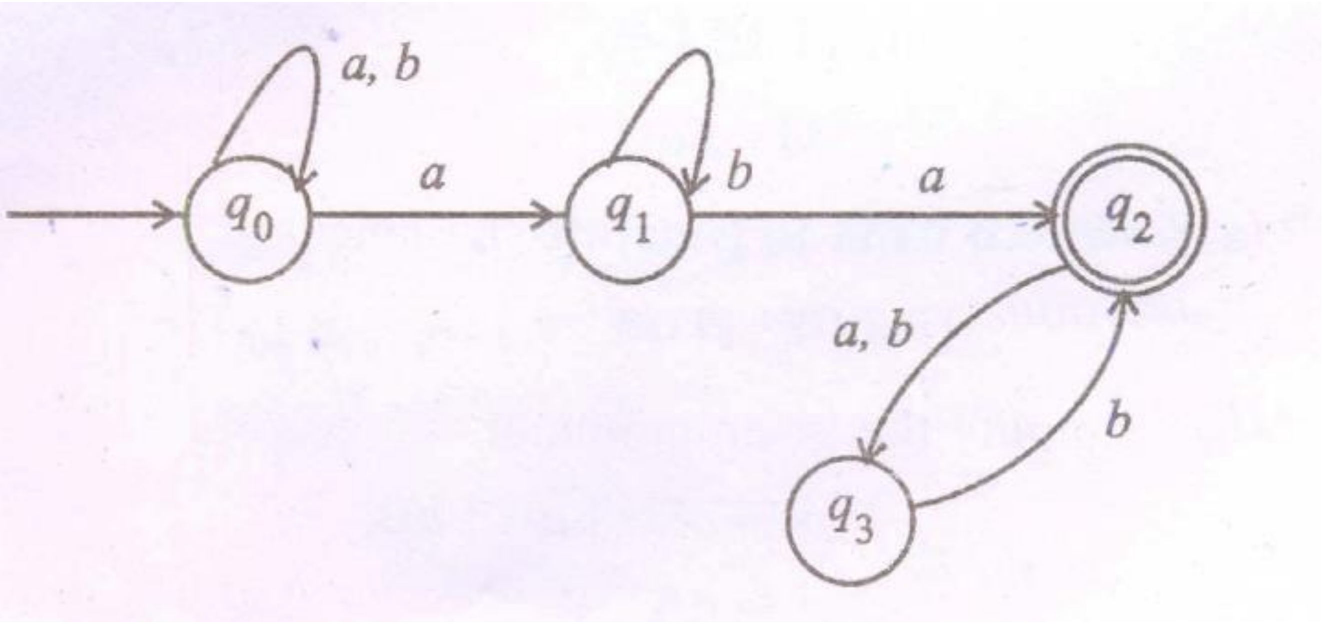
(g) Explain in detail – The Equivalence of PDA's and CFG's.

(h) Explain the following: (i) PCP (ii) Halting Problem.

SECTION-C

Attempt any **two** questions from this section. **(15 x 2 = 30)**

3. Construct minimised DFA for the given NFA.



4. Find out whether the following grammars generate the same language:

G_1: $A \rightarrow 0B \mid 1E$
$B \rightarrow 0A \mid 1F \mid \in$
$C \rightarrow 0C \mid 1A$
$D \rightarrow 0A \mid 1D \mid \in$
$E \rightarrow 0C \mid 1A$
$F \rightarrow 0A \mid 1B \mid \in$

G_2: $X \rightarrow 0Y \mid 0 \mid 1Z$
$Y \rightarrow 0X \mid 1Y \mid 1$
$Z \rightarrow 0Z \mid 1X$

5 (i) Write a CFG to generate the language:

$$L = \{0^m 1^n 0^{m+n} \mid m_1 n \geq 1\}$$

(ii) Simplify the given grammar:

$$S \rightarrow aSB \mid aA \mid bB$$
$$A \rightarrow aA \mid \in$$
$$B \rightarrow bB \mid \in$$