[4658] – 605

Seat No.	

T.E. (Info. Tech.) (Semester – I) Examination, 2014
THEORY OF COMPUTATION
(2012 Course)

Time : 3 Hours Max. Marks : 70

Instructions : *1) Neat diagrams must be drawn **wherever** necessary.*
*2) Black figures to the **right** indicate **full** marks.*
*3) Assume suitable data, if **necessary**.*

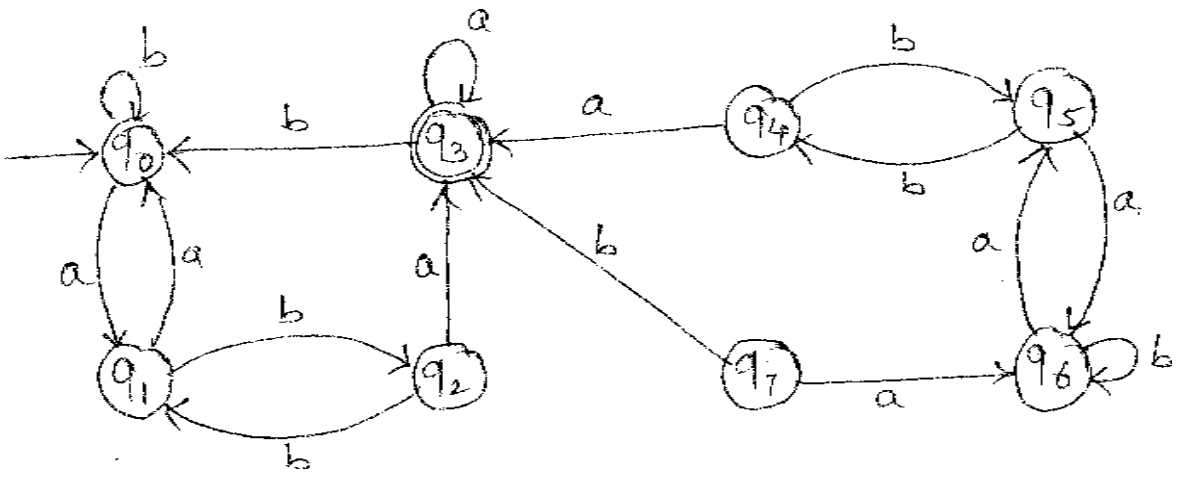
1. a) Write the formal definition of the following :
   i) Finite Automata
   ii) E-closure **4**

   b) Using pumping lemma for the regular sets prove the language

   $L = \left\{ a^{i^2} \mid i \geq 1 \right\}$ is not regular. **6**

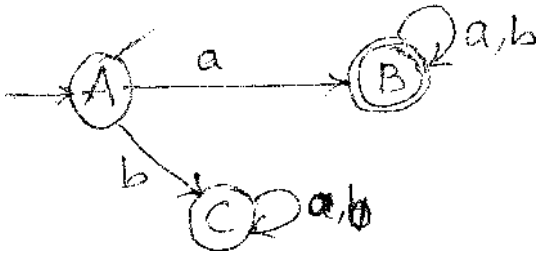
OR

2. a) Construct the minimum state automation equivalent to the transition diagram given as below : **6**



P.T.O.

b) Construct Regular Expression for the following transition diagram using Arden's theorem. **4**



3. a) Construct the parse trees for the strings using specified derivation for the given grammar G.

G = ({S, A, B}, {a, b}, P, {S})

P = {S $\rightarrow$ aB, S $\rightarrow$ bA

A $\rightarrow$ a, A $\rightarrow$ aS, A $\rightarrow$ bAA

B $\rightarrow$ b, B $\rightarrow$ bS, B $\rightarrow$ aBB}

Strings :

i) aaabbb (rightmost derivation)

ii) aababb (rightmost derivation). **4**

b) Describe CFG, Chomsky Normal Form and Greibach Normal Form, with suitable examples. **6**

OR

4. a) Remove Unit-productions from the given grammar.

P = { S $\rightarrow$ ABA|BA|AA|AB|A|B

A $\rightarrow$ aA|a

B $\rightarrow$ bB|b

} **4**

b) Define ambiguous grammar.

1) S $\rightarrow$ 0S|S|1S0S|$\in$

2) S $\rightarrow$ AA

A $\rightarrow$ aAb|bAa|$\in$

Consider above grammars. Test whether these grammars are ambiguous. **6**

5. a) Construct a PDA that accepts the following language using CNF.

$L = \{a^{2n} | n > 0\}$. **8**

b) Write formal definition of PDA. Explain its elements. What are different types of PDA ? What are the applications of PDA ? **8**

OR

6. a) Design a PDA accepting $\{a^n b^m a^n | m, n \geq 1\}$ simulate a PDA for the string "aabaa". **8**

b) Define post machine. Explain its elements. Show that the post machine is more powerful that PDA. **8**

7. a) Design a TM which accepts all strings of the form $a^n b^n$ for $n \geq 1$ and rejects all other strings. Draw the transition diagram. Simulate TM for some string. **10**

b) Write short notes on :

1) Universal Turing Machine
2) Multi-tape Turing Machine. **8**

OR

8. a) Design a TM to add two unary numbers. **8**

b) Design a TM that recognizes a string containing aba as a substring. **6**

c) Write a short note on Non deterministic Turing Machine. **4**

9. a) Show that for two recursive languages L_1 & L_2, each of the following is recursive.

i) $L_1 \cup L_2$ ii) $L_1 \cap L_2$ **8**

b) Define decidability. How to prove the given language is undecidable ? List some undecidable problems. **8**

OR

10. a) Write a short note on halting problem of a Turing machine. **8**

b) Explain the following : **8**

i) Recursive sets
ii) Turing reducibility.

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