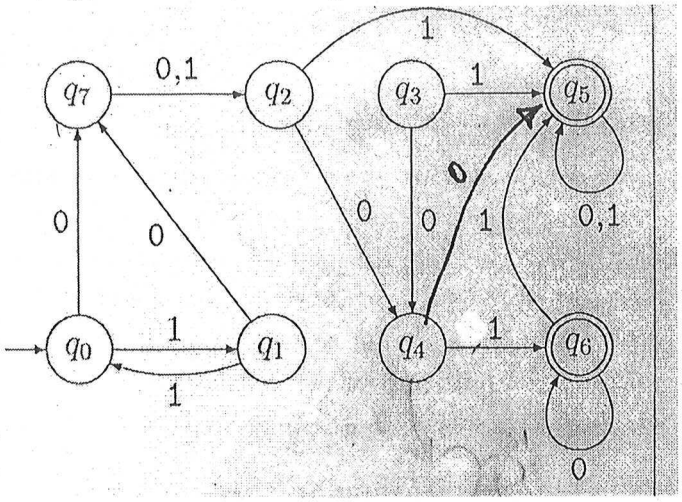
B.C.S.E. 3rd YEAR 1ST SEMESTER EXAMINATION 2018

Formal Languages and Automata Theory

Time: 3 hours | Full Marks: 100

Answer any ***five*** questions

1. a. The transition diagram of a DFA is given below. Form the table of distinguishabilities for this automaton and give the transition diagram of the minimum state equivalent DFA.



b. Give a proof of the method you have followed for finding the minimum state equivalent DFA.

12+8

2. a. Design a Turing Machine that accepts the language

$$L=\{ww^R | w \text{ is any string of } 0's \text{ and } 1's\}$$

by giving the transition diagram of the machine.

b. State the Halting Problem for Turing Machines. Prove that Halting Problem is undecidable.

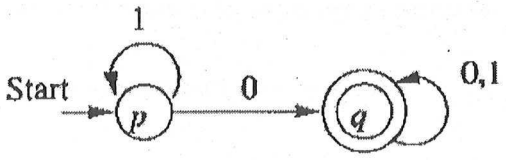
12+8

3. a. State the pumping lemma for regular languages.

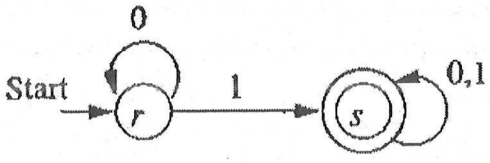
b. Show that $L = \{a^{n!} | n \geq 0\}$ is not regular.

c. The following DFA shown below first accepts all those strings of 0's and 1's that have at least one 0. The next DFA accepts all strings of 0's and 1's that have at least one 1. With this two DFA's, construct a third DFA accepting all strings of 0's and 1's that has at least one 0 and at least one 1, i.e., the intersection of first two languages.

(Contd... 2)



(a)



(b)

d. How would you decide whether two regular languages are equivalent?

3+5+6+6

4. a. Construct an NPDA that accepts the following languages on $\Sigma = \{a, b, c\}$

$$L = \{a^n b^m | n \leq m \leq 3n\}$$

b. Eliminate the $\in -productions$ from the following:

S → ABC
A → aA | ∈
B → bB | ∈
C → ∈

c. Prove that for every parse tree, there is a unique leftmost derivation and vice-versa.

6+4+(5+5)

5. a. State the pumping lemma for Context-Free languages.
b. Using the pumping lemma, show that the language $L = \{0^n 1^n 2^n | n \geq 1\}$ is not a Context-Free Language.
c. Show that Context-Free Languages are not closed under Intersection.

4+8+8

6. Write short notes on:
   a. Universal Turing Machines
   b. Recursive and Recursively Enumerable languages
   c. Chomsky hierarchy of languages
   d. P and NP classes of problems

5 x 4