UNIVERSITY OF RUHUNA
BACHELOR OF COMPUTER SCIENCE (SPECIAL) DEGREE
(SEMESTER II) EXAMINATIONS
December – 2016

Subject: Computer Science
Course unit: CSC4212 (Compiler Construction) Duration: 2 Hours

*Answer **All** Four (04) questions.*

1.

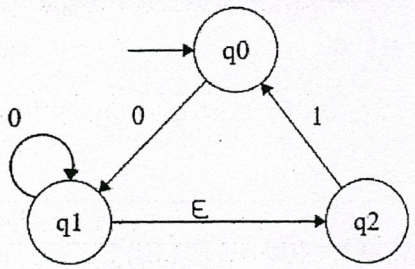
a. Find the languages defined by the regular expressions given below,

i. R1 = (a+b)* (aa+bb)

ii. R2 = a*b*

b. Write down three properties that differentiate non-deterministic finite automata from deterministic finite automata.

c. Parts i, ii & iii of this question are based on the following finite automaton.

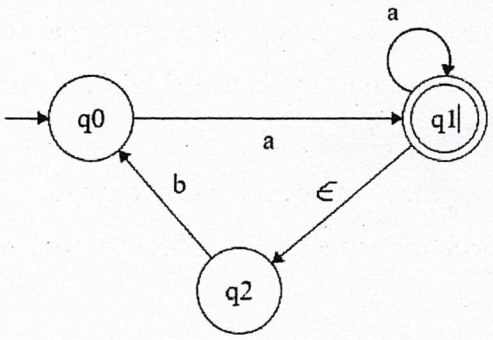


i. Show that this finite state machine represents a non-deterministic finite automaton.

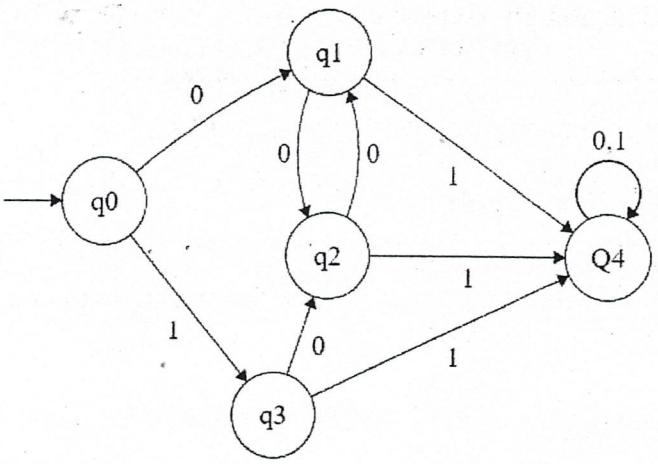
ii. Construct a transition table to represent this automaton.

iii. Out of the following strings, which string/s is/are accepted by the automaton?
0101, 00010, 000, 0110

d. Construct a DFA equivalent to the NFA given in the fowling figure.



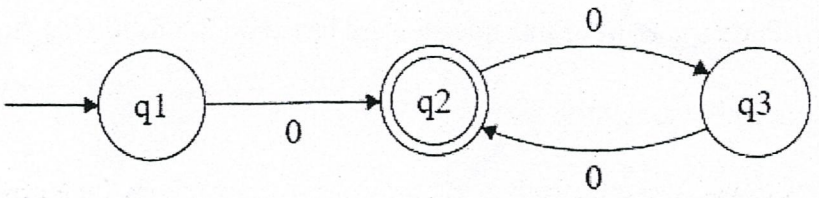
e. Minimize the DFA given in the following figure.



2.

a. State the Arden's theorem on regular expressions.

b. By using the equations and Arden's theorem, prove that Regular Expression corresponding to the following DFA is 0.(00)*



c. Give a NFA for regular expression r = (00 + 1)* (10)*

d. Construct automaton to recognize the languages defined by the following grammars. Explain each step clearly.

G = (N, T, P, S), N = (S, A), T = {0,1},

P { S →0S | 1A |1 , A →0A | 0S| 0 | 1 }

3.

a. Write short notes on the following topics.

   i. Front end components of a typical compiler.

   ii. Simplification of Context Free Grammars.

b. Compare and contrast Type (2) grammar with Type (3) grammar in Chomsky's grammar classification.

c. Consider the following grammar G with the production given by

   $S \rightarrow aB \mid bA$

   $A \rightarrow a \mid aS \mid bAA$

   $B \rightarrow b \mid bS \mid aBB$

   Where S is the start symbol and a and b are terminal symbols. Find the leftmost derivation and derivation tree for the string aaabbabbba.

d. Show that the Context Free Grammar (CFG) having production

   $A \rightarrow a \mid Aa \mid bAA \mid AAb \mid AbA$

   is ambiguous.

e. Convert the following grammar to equivalent Chomsky Normal Form.

   $S \rightarrow aAD$

   $A \rightarrow aB \mid bAB$

   $B \rightarrow b$

   $D \rightarrow d$

4.

a. Give formal definition of Pushdown Automata (PDA).

b. Design a PDA to accept the language L = {wCw^R | w ϵ (0 +1)* }by an empty stack.

c. Consider the following grammar over the alphabet (c, d, e}

$A \rightarrow ABC$
$A \rightarrow Bc \mid dA \mid \varepsilon$
$B \rightarrow eA$

Fill in the table below with the First and Follow sets for the non-terminals in this grammar.

	First	*Follow*
S		
A		
B		

d. LL(1) parsing table for the grammar

$$\{ E \rightarrow TE', E' \rightarrow +TE' \mid \varepsilon,\ T \rightarrow FT',\ T' \rightarrow *F\,T' \mid \varepsilon,\quad F \rightarrow (E) \mid id \}$$

is given in the following table. Show the operation of an LL(1) parser on the input string

id + id * id$

	id	+	*	(	)	$
E	E→TE′			E→TE′		
E′		E′→+TE′			E′→ε	E′→ ε
T	T→FT′,			T→FT′,		
T′		T′→ ε	T′→*F T′		T′→ ε	T′→ ε
F	F → id			F →(E)		

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