Roll No.

OBJECTIVE QUESTION

EXAMINATION: FINAL 2015 **COURSE CODE: CS- 2044**
TITLE: THEORY OF AUTOMATA **SEMESTER: 5th**
TIME ALLOWED: 25 Minutes **MAX MARKS: 14**

Multiple Choices: Select the best option. **14*1 = 14**

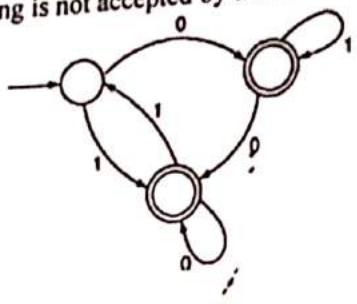
1. A language may be expressed by more than _____ regular expression.
   b) two b) one c) only one d) None of these
2. Let A = {0, 1}. The number of possible strings of length 'n' that can be formed by the elements of the set A is:
   b) n! b) n^2 c) n^m d) 2^n
3. If L1 and L2 are expressed by regular expressions r1 and r2 respectively, then the language expressed by r1 + r2 will be _____.
   b) Regular b) Non-Regular c) Undecideable d) None of these
4. Two regular expressions are said to be _____ if they generate the same language.
   b) even b) even-even c) different d) equivalent
5. In_____ there may exist more than one paths for certain string.
   a) FA b) TG c) GTG d) NFA
6. Which statement is correct:
   a) A Mealy machine generates no language as such
   b) A Moore machine generates no language as such
   c) A Mealy machine has no terminal state
   d) All of these
7. The language of all words (made up of a's and b's) with at least two a's cannot be described by the regular expression:
   a) a(a+b)*a(a+b)*(a+b)*ab* b) (a+b)*ab*a(a+b)*
   c) b*ab*a(a+b)* d) None of these
8. Identify the TRUE statement:
   a) A PDA is non-deterministic, it there are more than one READ states in PDA
   b) A PDA is never non-deterministic
   c) Like TG, a PDA can also be non-deterministic
   d) A PDA is non-deterministic, if there are more than one REJECT states in PDA
9. In _____ of FA's, the moment a final state of first FA is entered, the possibility of the initial state of second FA will be included as well.
   a) closure b) addition c) concatenation d) All of these
10. Which of the folowing definitions below generates the same language as L, where **$L = \{x^n y^n$ such that $n >= 1\}$?**
    I. $E \rightarrow xEy \mid xy$
    II. $xy \mid (x^+ xyy^+)$
    III. x^+y^+
    a) I only b) I & II c) II & III d) II only
11. Any string of terminals that can be generated by the following CFG is
    $S \rightarrow XY$
    $X \rightarrow aX \mid bX \mid a$
    $Y \rightarrow Ya \mid Yb \mid a$
    a) has at least one 'b' b) should end in a 'a'
    c) has no consecutive a's or b's d) has at least two a's
12. Which of the following languages CANNOT be defined by Finite Automata?

P.T.O

a) {ab, abab, ababab, abababab, ...}
b) {abb, aabbbb, aaabbbbbb, aaaabbbbbbbb, ...}
c) {a, b, aa, bb, aaa, bbb, aaaa, bbbb, ...}
d) {a, aa, aba, abba, abbba, abbbba, abbbbba, ...}

13. Transition function of Turing machine maps.
a) $\Sigma \times Q \rightarrow \Gamma$ b) $Q \times \Gamma \rightarrow Q$ c) $\Sigma \times \Gamma \rightarrow Q$ d) $Q \times \Sigma \rightarrow Q$

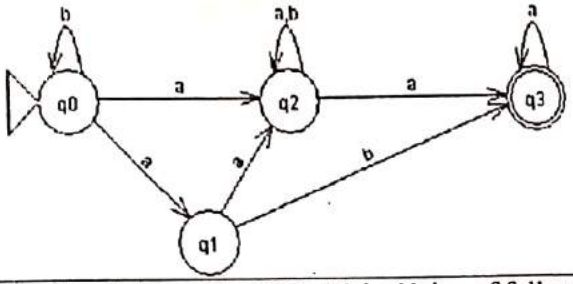
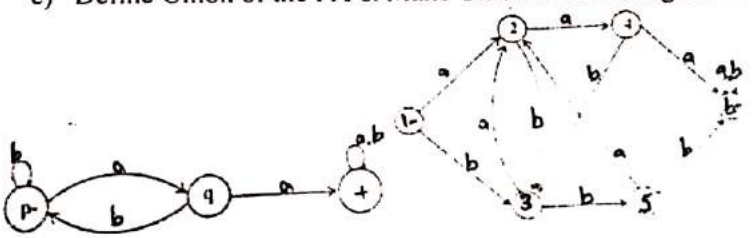
14. Which string is not accepted by the following FSA?



a) 00111 b) 01010 c) 00110 d) 11010

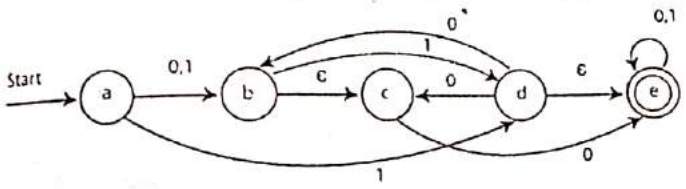
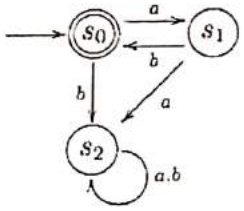
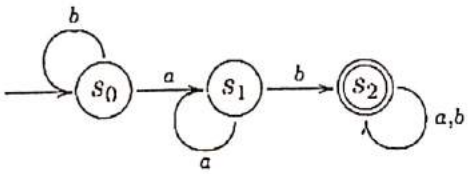
EXAMINATION: FINAL 2015
TITLE: THEORY OF AUTOMATA
TIME ALLOWED: 155 Minutes
Note: Attempt any **FOUR** questions.

COURSE CODE: CS- 2044
SEMESTER: 5th
MAX MARKS: 56

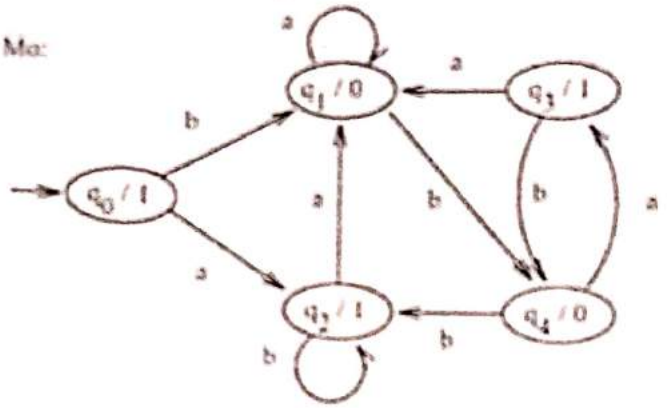
Q.No.	Question	Marks
2	Define the following terms and give at least one example in each case: 1) Regular Expression 2) Non-deterministic Finite State Automation (NDFA) 3) Pushdown Automata (PDA) 4) Moore and Mealy Machines 5) Generalized Transition Graph 6) Kleene's Theorem 7) Context Free Grammar	14
3	c) In each regular expression draw the DFA recognizing the corresponding languages: 5) (1+110)*0 6) (111+100)*0 7) 1(01+10)*+0(11+10)* 8) 1(1+10)*+10(0+01)*	8
	d) Convert the following NFA to equivalent DFA. 	6
4	c) Define Union of the FA's. Make Union of following FA's: 	7
	d) Convert the following Grammar into CNF: G: S → aABC | a A → aA | a B → bcB | bc C → cC | c	7
5	b) Make GTG of language L of strings of alphabets defined over ∑ = {a, b}, beginning and ending in different letters.	7
	b)Construct a Mealy machine that takes a string of a's and b's as input and outputs a binary string with a 1 at the position of every second double letter. For example, for **ababbaab** the machine produces **00001010** and for input **bbb** the output string **011** is produced.	7
6	c) Design a PDA for $L = \{WCW^R \mid W \in \{0, 1\}^*\}$	6
	d) What is Turing machine describe in detail. Design a Turing machine for the palindrome **aabaabaa**.	8

EXAMINATION: FINAL Fall-2017
TITLE: THEORY OF AUTOMATA
TIME ALLOWED: 155 Minutes
Note: Attempt any **FOUR** questions.

COURSE CODE: CS- 2044
SEMESTER: 5th
MAX MARKS: 48

Q.No.	Question	Marks
2	Define the following terms and give at least one example in each case: 1) Describe Chomsky's classification of languages 2) Non-deterministic Finite State Automation (NDFA) 3) Pushdown Automata (PDA) 4) Difference between Moore and Mealy Machines 5) Define Generalized Transition Graph 6) Give recursive definition for the language of Palindrome having ODD length.	12
3	a) In each regular expression draw the DFA recognizing the corresponding languages: 1) A set of strings of 0's and 1's not containing a substring **001**, over $\Sigma = \{0, 1\}$ 2) a(bba + baa)*bb 3) 1(01+10)*+0(11+10)*	6
	b) Convert the following NFA to equivalent DFA. 	6
4	a) Define Union of the FA's. Make Union of following FA's:  Fa-1  Fa-2	6
	b) Formally define a grammar symbol in CFG is useful. Also identify the useful and useless symbols in the following CFG: $S \rightarrow AB \mid CA$ $B \rightarrow BC \mid AB$ $A \rightarrow a$ $C \rightarrow aB \mid d.$	6

P.T.O

5	a) Construct CFG for the following language: i) $(a + b)^*baa(a + b)^*$ j) Palindrome	6
	b) Design a PDA for $L = \{ww^R \mid w\epsilon(a+b)^*\}$	6
6	a) For the following Moore machine (M_0), draw a transition table and output table. Also draw outputs for **"abbabbaab"** M_0: 	6
	b) Design a Turing machine for $L = \{a^nb^n \mid n \geq 1\}$.	6

EXAMINATION: FINAL Fall-2017
TITLE: THEORY OF AUTOMATA
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Note: Attempt any **FOUR** questions.

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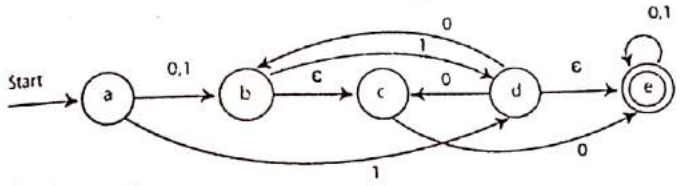
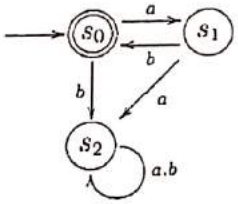
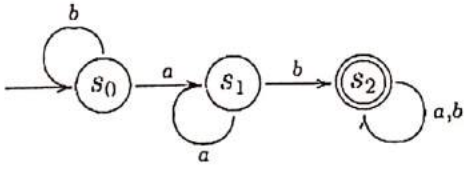
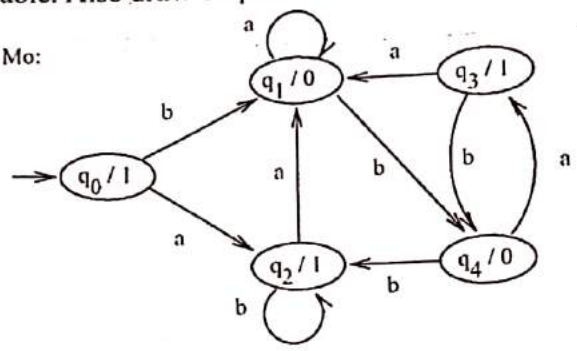
	b) Convert the following NFA to equivalent DFA. 	6
4	a) Define Union of the FA's. Make Union of following FA's:  Fa-1  Fa-2	6
	b) Formally define a grammar symbol in CFG is useful. Also identify the useful and useless symbols in the following CFG: $S \rightarrow AB \mid CA$ $B \rightarrow BC \mid AB$ $A \rightarrow a$ $C \rightarrow aB \mid d.$	6

P.T.O

5	a) Construct CFG for the following language: i) $(a + b)^+baa(a + b)^*$ j) Palindrome	6
	b) Design a PDA for $L = \{ww^R \mid w\epsilon(a+b)^*\}$	6
6	a) For the following Moore machine (M_0), draw a transition table and output table. Also draw outputs for "**abbabbaab**" Mo:  	6
	b) Design a Turing machine for $L = \{a^nb^n \mid n \geq 1\}$.	6

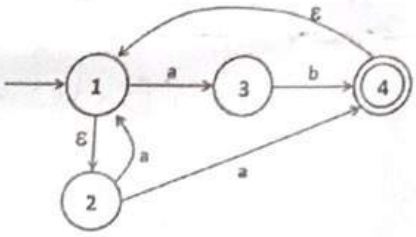
Department of Computer Sciences, GC University Lahore

BSCS FINAL EXAMINATION 2018

SUBJECT: Theory of Automata MAX MARKS: 48
COURSE CODE : CS-2044 TIME ALLOWED: 120 Mnts

Note: Attempt any **FOUR** questions.

Q.2: a) a) Construct an equivalent DFA from the following NFA–ε: (6+4+2)



b) You want to build a Moore machine that will recognize the sequence x = 0110 and output the sequence z = 0001 as this sequence occurs. What will be the output of string "01101010101".

Q.3: a) Simplify the following CFG and convert it into CNF. (6+3+3)

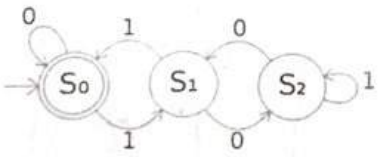
$S \rightarrow BbA \mid aB \mid Ab$
$A \rightarrow abB \mid \varepsilon$
$B \rightarrow bAA \mid \varepsilon$

b) Show that L = { $\mathbf{a^n b^{2n}} \mid n \geq 1$} is not regular using Pumping Lemma.

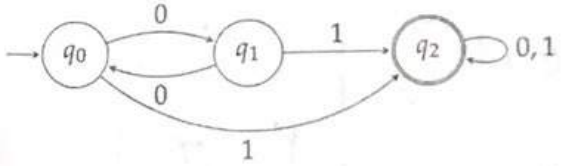
c) Construct DFA that accepts ($\mathbf{ab^* + abab + a^*b^+}$) over the alphabets $\Sigma = \{a, b\}$.

Q.4: a) FA1 accepts the language defined by the RE **r1** and FA2 accepts the language defined by the RE **r2** from the following figures. Find FA3 accepts the language defined by the RE (**r1 + r2**) by using Kleene's theorem. (8+4)

FA1



FA2



b) Formally define a grammar symbol in CFG is useful. Also identify the useful and useless symbols in the following CFG:

$S \rightarrow AB \mid CA$
$B \rightarrow BC \mid AB$
$A \rightarrow a$
$C \rightarrow aB \mid d.$

Q.5: a) Describe the PDA to accept the language L = { $\mathbf{a^{2n} b^{3n}} \mid n \geq 1$} by an empty stack. Also verify the string "aaaabbbbbb". (6+2+4)

b). Show that the given CFG is ambiguous with the help of string "abababb".

$S \rightarrow a \mid abSb \mid aAb$
$A \rightarrow bS \mid aAAb$

Signature:_____

0077-BSCS-20

Name: _____ Roll No.: _____ Section: ____

Q.6: a) Construct a CFG to generate: (2+2+6+2)

i) $(a + b)^* (ab + ba) (aba)^+$

ii) signed or unsigned decimal numbers.

b) Design a TM which accepts all length **Palindrome**. Also verify the string "010010010".

Department of Computer Science
Theory of Automata – CS-2044
Online Mid Term Examination – Spring-2021
Total Marks – 20 **Date: 07-04-2021**
Start Time 09:30 AM **End Time: 11:00 AM** **Submission Deadline : 11:30 AM**

Attempt All Questions.

Question No. 01 **(3+2)**

A. MCQ – Write the correct option on your answer script (file).

1. Let ∑={a,b,b,…z} and A={hello, good bye}, B={get, put}, the (A*∩B) U (B*∩A) can be represented by
   a) {hello,good bye, put, get, ε }
   b) {hello,good bye, ε}
   c) {put, get, ε }
   d) {}
2. Let Q={q_0,q_1, q_2}, where q_0 is start state and q_1 is final state. For DFA D there exists following transition functions
   δ (q_0,a)= q_1 , δ (q_0,b)= q_2 , δ (q_1,a)= q_0 and δ (q_1,b)= q_1
   Which of the following will not be accepted by D.
   a) ababaabaa
   b) abbbaa
   c) abbbaabb
   d) abbaabbaab
3. You are asked to make an automaton which accepts a string for all the occurrences of 'abba' in it. How many transitions would you use such that application process all possible strings.
   a) 4
   b) 5
   c) 9
   d) 11
4. L* is an infinite set iff |L|≥1 and L≠{ε}
   a) If L={ε}, then L* = _____
   b) If L = Φ, then L* = _____
5. Consider the regular expression (0+1)*1(1+01)*. The language described by the given regular expression contains _____ string of length less than 4.
   a) 7
   b) 10
   c) 11
   d) 12
6. Consider ∑={x,y} Which of the following regular expression doesn't contain the substring 'xy'.
   a) (xy)*
   b) (yx)*
   c) (x*y*)*
   d) (y*x*)

B. Question from Self Review Assignment

Please refer to self-review assignment covering Kleene's theorem. Answer the following question.

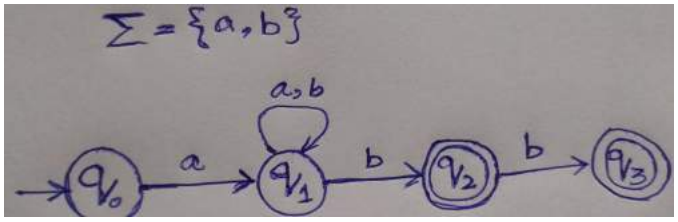
Is the machine for r1 + r2 the same as the machine for r2 + r1? Why ?

Question No. 02 **(2+2+1)**

a) Let L1={cd,dd} and L2 = {cd,dd,dddd}. Show that L1* = L2*
b) Let L1={cd,dd} and L2 = {cd,dd,ddd}. Show that L1* ≠ L2*, but L1 ⊂ L2
c) Does it makes any difference if the operator '*' is replaced with operator '+' in above two cases.

Question No. 03 **(1+2+2)**

a) Consider the ∑ = {0,1} , write a regular expression for the language such that there are at-least two 0's in all words.
b) Build a DFA that accepts only those words of the language that ends with double letter. The ∑ = {0,1} and the exampled words are {00,11,000,111,011,100,…..}
c) Convert the following NFA to its equivalent DFA



Question No. 04 (2+3)

a) Define a Mealy machine that tells how many times exactly triple a's and triple b's appears in a long string.
b) Consider the Kleene's theorem,
"Every language that can be defined by regular expression can also be defined by finite automata".
Let a language is defined by r1 and same language is defined by FA1 and a language is defined by r2 and same language is defined by FA2. Prove that the language defined by r1+r2 can also be defined by some finite automata.