National University of Computer & Emerging Sciences, Karachi
Fall -2017 CS-Department
MidTerm 1
19th September 2017, 1:00 pm – 02 pm

Course Code: CS301	**Course Name: Theory of Automata**
Instructor Name: Muhammad Shahzad	
Student Roll No:	**Section No:**

SOLUTION PAPER

Time: 60 minutes. **Max Marks**: 50 points

Question 1: Select the best answer and write either A, B, C or D from the options given below each statement: [10]

1) (a* + b*)* = (a + b)* this expression is ___________ A. True B. False	6) What do automata mean? A. Something done manually B. Something done automatically
2) Alphabet S = {a, Bc, cC} has _____ number of letters A. 1 B. 2 C. 3	7) If S = { x }, then S* will be A. {x,xx,xxx,xxxx,…} B. {^ ,x,xx,xxx,xxxx,…}
3) If S = {aa, bb}, then S* will not contain A. aabbaa B. bbaabbbb C. aaabbb D. aabbaaaa	8) language can be expressed by more than one FA". This statement is _______ A. True B. False C. Sometimes true & sometimes false D. None of these
4) (a+λ)*b + λ is equivalent to: A. (a+b)a*b B. (a+b)a*b + λ C. (a+b) a*ab + λ D. none of these	9) (aa+bb*)* is equivalent to: A. (aa+ab)* B. (b*aaab*)* C. (aa+a+b)* D. None of these
5) (b+ab)* (a + λ) is equivalent to: A. b*(abb*)* + b*(abb*)*a B. b*(ab*)* (a+ λ) C. b*(abb*)* D. none of these	10) In an FA, when there is no path starting from initial state and ending in final state then that FA A. accept null string B. accept all strings C. accept all non empty strings D. does not accept any string

Question 2: Write REs of the following: [10]

A. Set of all string having substring 00

(0+1)*(00)(0+1)*

B. The language of all strings over the alphabet { a, b } that contain exactly two a's.

b*ab*ab*

C. Set of all string end with 01

(0+1)*01

D. The language, defined over G ={a, b}, of words starting with double a and ending in double b

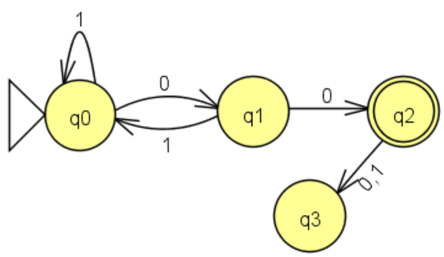
aa(a+b)*bb

E. Strings not containing the substring 110.

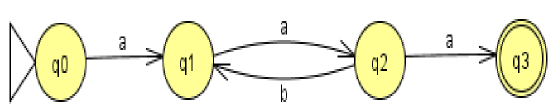
(0+10)*1*

Question 3: Draw FA of the following REs: [10]

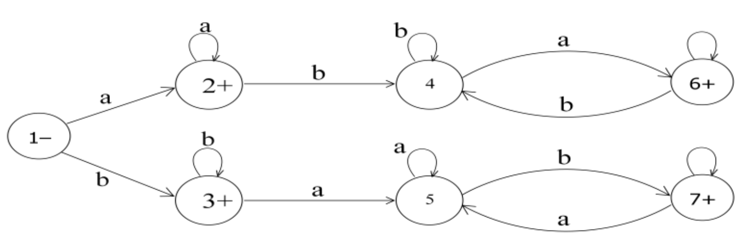
A. (0+1)*00



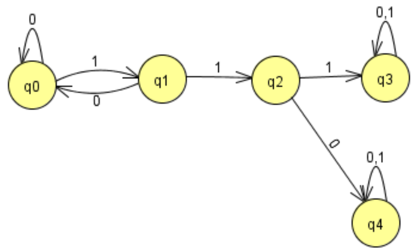
B. a (ab)* aa



C. a+b + a(a+b)* a + b(a+b)*b

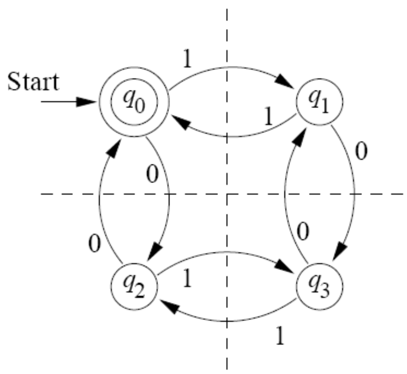


D. (0+1)*111(0+1)*

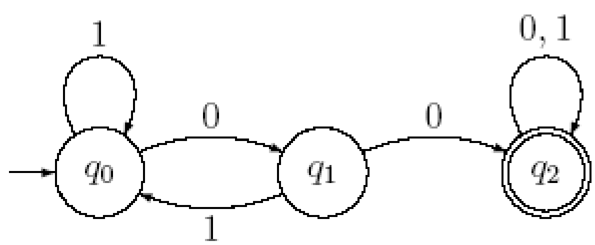


Question 4: Write the language that is accepted by each of the following: [10]

A.



B.



A.

(aa+bb+(ab+ba)(aa+bb)*(ab+ba))*

B.

(0+1)*00(0+1)*

Question 5: Give the recursive definition of following languages: [10]

A. "number multiple of three" L={3, 6, 9, 12, ……}

Step 1

3 is in L

Step 2

If x is in L, then is x + 3

Step 3

No strings except those constructed in above, are allowed to be in L.

B. The language PALINDROME, defined over Σ = {a,b}

Step 1:

a and b are in PALINDROME

Step 2:

if x is palindrome, then s(x)Rev(s) and xx will also be palindrome, where s belongs to Σ^*

Step 3:

No strings except those constructed in above, are allowed to be in palindrome

C. The language L, of strings containing exactly aa, defined over Σ={a, b}

Step 1:

aa is in L

Step 2:

s(aa)s is also in L, where s belongs to b*

Step 3:

No strings except those constructed in above, are allowed to be in L

D. The language {anbn }, n=1,2,3,… , of strings defined over Σ={a,b}

Step 1:

ab is in $\{a^n b^n\}$

Step 2:

if x is in $\{a^n b^n\}$, then axb is in $\{ a^n b^n \}$

Step 3:

No strings except those constructed in above, are allowed to be in $\{ a^n b^n \}$