National University of Computer & Emerging Sciences, Karachi
Spring-2018 CS-Department
MidTerm 1
23rd February 2018, 10:30 am – 11:30am

Course Code:	Course Name: Theory of Automata
Instructor Name / Names: M. Shahzad/Shaharbanoo/Subhash Sagar	
Student Roll No:	Section No:

Instructions:

- Return the question paper.
- Read each question completely before answering it. There are **3 questions and 2 pages**.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.
- All the answers must be solved according to the sequence given in the question paper.
- This paper is subjective. All the questions should be attempted on the answer sheet.
- All questions carry equal marks and equally distributed in sub parts.

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

Question 1 (20 points = 1 * 20):

Select the best answer and write either A, B, C or D from the options given below in each statement:

1) $(a^* + b^*)^* = (a + b)^*$ this expression is _____ A. **True** B. False	2) $(L1 \cup L2)^* = L1^* \cup L2^*$ A. True B. **False**
3) $(ab)^*a = a(ba)^*$ A. **True** False	4) $L1^* = L1^+ \cup \emptyset$ A. True B. **False**
5) $(L1 \cup L2)^* = (L2 \cup L1)^*$ A. **True** B. False	6) $(a \cup b)^* b (a \cup b)^* = a^* b (a \cup b)^*$ A. **True** B. False
7) $[(a \cup b)^* b a (a \cup b)^* \cup a^*b^*] = (a \cup b)^*$ A. **True** B. False	8) $(L1L2)^* = L1^*L2^*$ C. True D. **False**
9) $[(a \cup b)^* b (a \cup b)^* \cup (a \cup b)^* a (a \cup b)^*] = (a \cup b)^+$ A. **True** B. False	10) $a+ = a. a^*$ A. **True** B. False
11) If S = { x }, then S* will be A. {x,xx,xxx,xxxx,…} B. **{^ ,x,xx,xxx,xxxx,…}**	12) If S = {aa, bb}, then S* will not contain A. aabbaa B. bbaabbbb C. **aaabbb** D. aabbaaaa

13) Language can be expressed by more than one FA's. This statement is _____
   A. True
   B. False
   C. Sometimes true & sometimes false
   D. None of these
	14) (b+ab)*(a+λ)is equivalent to
	   A. b*(abb*)*+b*(abb*)*a
	   B. b*(ab*)*(a+λ) (There is aa but not in given RE)
	   C. b*(abb*)* (not ending in a)
	   D. None of these

15) (aa+bb*)* is equivalent to:
   A. (aa+ab)*
   B. (b*aaab*)*
   C. (aa+a+b)*
   D. None of these
	16) (a+b+c)*a(a+b+c)*b(a+b+c)*c(a+b+c)*is equivalent to
	   A. (b+c)* a(a+c)* b(a+b)* c(a+b+c)* (Right Choice)
	   B. (a+b+c)* a(b+c)* b(a+c)* c(a+b+c)*
	   C. (b+c)* abc(a+b+c)* (aabc not belong to this)
	   D. None of these

17) 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
	18) (aa+bb)*is equivalent to
	   A. (aa+ab)*
	   B. (aa)*+(bb)*
	   C. (aa+b)*
	   D. None of these

19) (a+b)*(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
	20) What does automata means
	   A. Performs operation manually
	   B. Performs operation automatically

Question 2 (20 points = 10 * 2):

a) Consider the language L which recognize the string w defined over ∑ = {a,b,0,1 }, if w belong to language then it must satisfies the following conditions:

1. |w|<=2
2. String must start with either a or b.
3. String can end with any of the alphabets.

Find Regular Expression and draw DFA of the above given language?

b) Design NFA's to recognize the following set of strings
1. abc, abd, aacd. Assume the alphabet is {a,b,c,d}.
2. 0101, 101, and 011.

Question 3 (20 points = 10 * 2):

Consider the following expressions:

    A. ((a ∪ b) ∪ (ab))*
    B. $(a^+ a^n b^n)$
    C. ((ab)* ∅)
    D. (((ab) ∪ c)*∩(b ∪ c*))
    E. (∅* ∪ (bb*))

(ii) Which of the above is not a regular expression. Give precise reasoning. And for each of the above that is a regular expression, give a simplified equivalent regular expression.

(iii) For each of the above that is a regular expression, give descriptive definition of that language.

BEST OF LUCK!