Formal Language and Automata Theory/ CS-3003/CSE&IT/5th/2017

Mid-Semester Examination

School of Computer Engineering

KIIT University, Bhubaneswar-24

Time:1 hr 30 min ***Full Mark: 25***

(Answer Any Five Questions including Q1)

Q1. [1×5]

a. Construct an NFA for the regular expression *ab(a*ab*)*ba* over Σ={a,b}

b. Design an NFA in 5 states for the set $\{abab^n : n\geq 0\}$ U $\{aba^n : n\geq 0\}$.

c. Is the distinguishability relation of states of a DFA transitive. Answer with justification.

d. Let L_1 and L_2 be two languages over the same alphabet. Then $L_1 \oplus L_2 = L_1 \cap L_2$. (True/False). Answer with justification.

e. $L=\{wxw^R \mid w,x \in\{0,1\}^+\}$ is regular. (True/False), where, W^R= Reverse of w. Justify your answer.

Q2. a. Construct a DFA that recognizes the language L={ w| w is any string except 11 and 111} over Σ={0,1}.

b. Using pumping lemma prove that the language $L=\{a^ib^j \mid i,j\geq 0$ and $|i-j|$ is prime is not regular

Q3. Write the Regular Expression for the following languages over Σ={a,b}. [1×5]

a. L_1={w| w contains all strings with at most two occurrences of substring aa.}

b. L_2={w| w contains set of strings of the form a^mb^n such that (m+n) is even}.

c. L_3={w| w does not end with aba}

d. L_4={w| w has an odd number of a's and starts and ends with b}

e. L_5={ w| w ends with a and does not contain bb}

Q4. a. Construct a minimal DFA which accepts all the strings which neither contains *aa* nor ends with *ab* over Σ={a,b}. [3]

b. Let r_1= (aba+b) and r_2=(ba*+a). Construct an nfa which accepts L(r), where, r=(aba+b)*(ba*+a). [2]

Q5.a. Construct a DFA that accepts the language L={w| w does not contain a substring abc} over Σ={a,b,c}. Convert this DFA to regular expression using state elimination method. [3]

b. Let L_1 and L_2 are two languages over the same alphabet Σ. Given that L_1 and L_1L_2 both are regular. Prove or disprove L_2 must be regular. [2]

Q6.a. Consider the following DFA [3]

δ	0	1
→ A	B	F
B	G	C
*C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

Construct the equivalent minimal DFA for it.

b. What languages do the regular expressions ϕ^*, $a\phi$, λ^* denote? [2]

Q7. a. Consider the language $L=\{a^n \mid n \text{ is not a perfect square}\}$. Prove that above language is not regular using pumping lemma. [3]

b. State pumping lemma for regular languages. [2]