Formal Language and Automata Theory/CS-3003/CSE, IT & CSCE/5th/2019

Mid-Semester Examination

School of Computer Engineering

KIIT (DU), Bhubaneswar-24

Time: 1 hr 30 min ***Full Mark: 20***

(Answer Any Four Questions including Q1)

Q1. Answer all parts: [1×5]

a. Differentiate between NFA and DFA, explain with an example.
b. Design an NFA with 4 states for the set $\{abc, abcd\}^*$.
c. Design a minimal DFA for $r = (b^*a^* + ab + \lambda)^*$.
d. Which language $(\phi^*)^*$ and $a.\phi$?
e. Suppose $L_1 \cup L_2$ is regular and L_1 is finite. Can we conclude that L_2 is regular? True/False Justify your answer.

Q2. Design a DFA for the language over $\sum = \{a, b\}$ [5]

a. $L = \{w_1 abb w_2 : |w_1| \geq 3\ |w_2| \leq 2\}$.
b. $L = \{w: n_a(w) \bmod 3 < n_b(w) \bmod 3\}$.

Q3. Write Regular Expressions for the following languages over $\sum = \{a, b\}$. [2+3]

a.

i. $L_1 = \{uwu | u, w \quad \sum^*, |u| \leq 2\}$
ii. $L_2 = \{u \mid u$ has at least one triplet letter (e.g. *aaa* or *bbb*)$\}$
iii. $L_3 = \{u \mid u$ has even number of *a*'s and odd number of *b*'s$\}$
iv. $L_4 = \{u \mid |u|$ is at least 15 and at most 20$\}$

b. Design a DFA for the set of all nonnegative integers divisible by 4 (string symbols are 0, 1, 2, 3, 4, 5, 6, 7, 8 & 9).

Q4. [5]

a. Let L_1 and L_2 be two languages over the same alphabet $\sum$. Given that L_1 and L_1L_2 both are regular. Prove or disprove L_2 must be regular.

b. Construct a DFA that accepts the language $L = \{w |$ w does not contain a substring *abc*$\}$ over $\sum = \{a, b, c\}$. Convert this DFA to regular expression using state elimination method.

Q5.

Convert given NFA to equivalent DFA [5]

Delta	0	1
→ A	B, D	B
B*	C	B, C
C	D	A
D*	-	A

Is it minimal or not? If not find equivalent minimal DFA for it.