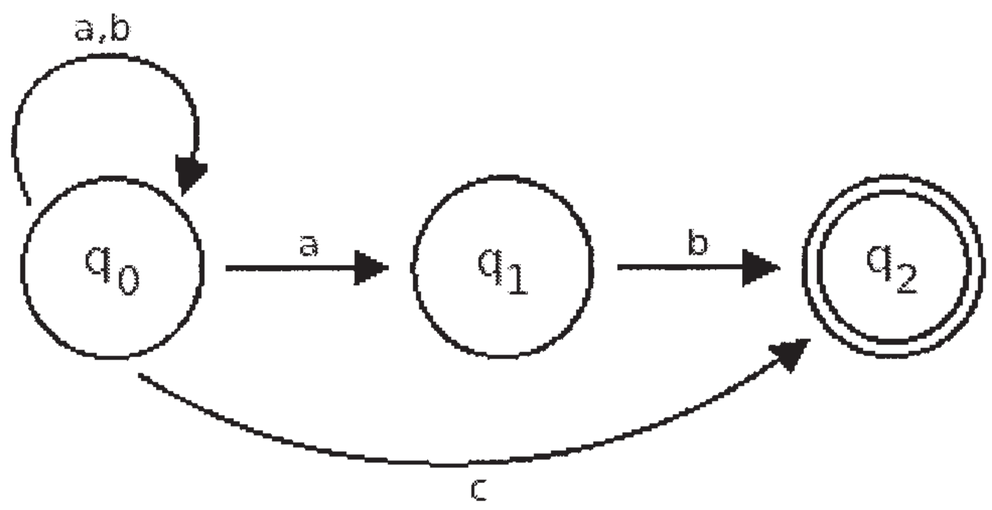
PANDIT DEENDAYAL PETROLEUM UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
RE- EXAMINATION MAY 2019

B. Tech Computer Engineering

Semester V

Course Name : Theory of Computation Course Code : 18CP 302 Max. Marks: 100

1.	a	Design a DFA for the language $L=\{w \mid w \in (a,b)^*$, *w starts and ends with same symbol}.* Also write the regular expression for the same. (6)	(20)
	b	Convert the following NFA to a DFA. (6) 	
	c	State pumping lemma for regular languages. Prove that language $L=\{a^p$, p is prime $\}$ is not regular using pumping lemma. (8)	
2.	a	i. Find a regular expression corresponding to the language L_1 of all strings over the alphabet {a, b} that do not end with ab. (3) ii. Whether the above language is regular? Justify. (2)	(20)
	b	Write context free grammar for the following Languages L_2 and L_3. Also design separate push down automatas to recognize the same. (10) $L_2 = \{a^i b^j c^k \mid i = j \text{ or } i = k\}$. $L_3 = \{ a^n b^m c^{2n} \mid m,n \geq 1\}$.	
	c	Show that the grammar G: $E \rightarrow E+E \mid E*E \mid (E) \mid a$ is ambiguous. Construct an unambiguous grammar equivalent to the grammar G. (5)	
3.	a	State whether context free languages are closed under the operations: i) union, ii) intersection and iii) complementation. Justify your answer with necessary proof. (5)	(20)
	b	State and prove "*size of a parse tree*" theorem with respect to context free languages. (5)	
	c	Given the following grammar G with production rules S → ASB | ε ; A →aAS | a; B →SbS | A | bb; Can you apply CYK algorithm on G to test the membership of the string w=aabb in L(G)? Justify your answer mentioning the necessary changes that you make in G. Show the complete steps in testing the membership. (10)	

4.	a	Draw the PDA M for the language $L_4 = \{a^n\ b^n \mid n \geq 1.\}$ Also derive context free grammar form the PDA M such that L(M)=L_4. (10)	(20)
	b	What is a Turing machine? Design a Turing machine for recognizing $L=\{wcw \mid w \in (a,b)^*\}$. You need to show the tape movement for the input *abbcabb*. (10)	
5.	a	(i) State and prove Halting Theorem. (6) (ii) Write a short note on universal Turing machines. (4)	(20)
	b	State PCP and MPCP problems. Whether they are decidable or not? Justify your answer with necessary proof. (10)	