B.E. (Computer Engineering) Fifth Semester (C.B.S.)

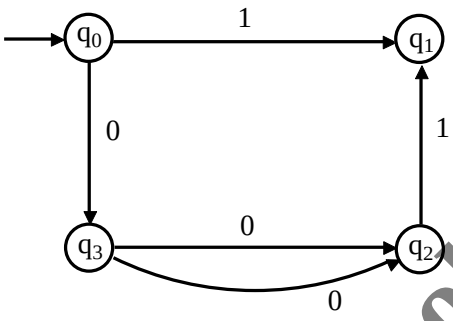
Theory of Computation

P. Pages : 4 **TKN/KS/16/7448**

Time : Three Hours * 0 8 6 4 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Convert the following NFA to DFA : **6**



b) Design a DFA to accept string xyy. over a alphabet {x, y}. **4**

c) Consider the string sita. Write its prefix, suffix and proper prefix. **3**

OR

2. a) Finite state machine is represented by state function (STF) and machine function (MAF), explain both with suitable example. **4**

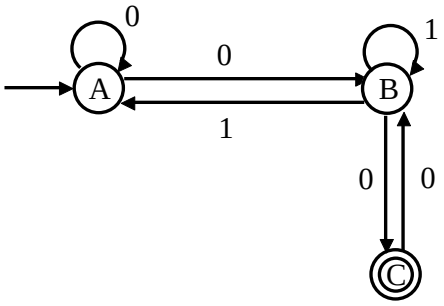
b) Draw the transition graph from the given transition table. Check whether it is DFA or not. Justify your answer. **5**

	Q \ Σ	a	b
→	A	D	B
	B	C	B
*	C	B	A
	D	–	D

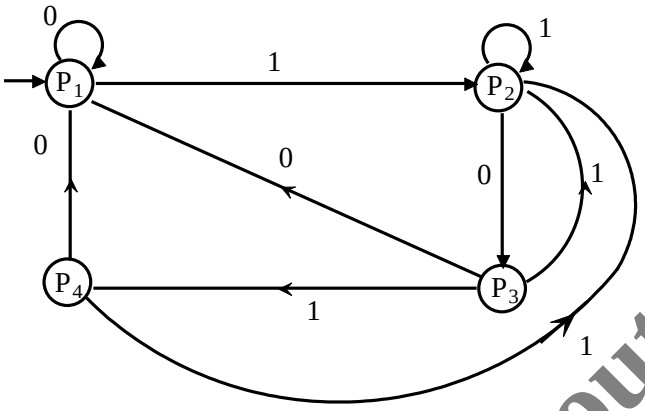
c) Draw and explain the Moore and Mealy machine. **4**

3. a) Consider the transition system given in below figure. Prove that the string recognized is **6**

$$\left(0+0(1+00)^*1\right)^*\ 0(1+00)^*0$$



b) Find the Regular expression corresponding to the given transition diagram : **7**



OR

4. a) Convert the following right linear grammar into left linear grammar. **7**

$S \rightarrow xyxB \mid yx$

$B \rightarrow yxxB \mid yxC$

$C \rightarrow y$

b) Prove the following : **6**

(Make use of identities for regular expressions)

$\in + b^*(abb)^*(b^*(abb)^*)^* = (b+abb)^*$

5. a) Define ambiguous and unambiguous grammar. Check whether the given grammar is ambiguous or not. Justify your answer for the string aaa bb abb. **8**

$E \rightarrow aEEb / aF / bE / aG / \in$

$F \rightarrow E / bG$

$G \rightarrow b$

b) For the grammar given below : **6**

$P \rightarrow (E) / b$

$E \rightarrow E, P / P$

generate the string (b, (b,b))
using left sentential and right sentential form.

OR

6. a) Reduce the grammar G given below to CNF. **6**

$$G = \{S \to aAD \quad A \to aX \mid bAX$$
$$X \to d$$
$$D \to b\}$$

b) Draw neatly the model of push Down Automata (PDA) and write 7 – tuples used for the design of PDA. And construct the PDA for the language **8**

$$T = \left\{\omega \in r^m u^m \mid m \geq 1 \;\&\; n_r(\omega) = n_u(\omega)\right\}$$

where $n_r(\omega)$ is the number of r in ω.
and $n_u(\omega)$ is the number of u in ω

7. a) Explain with neat diagram, the general model of Turing Machine, and use of each component used in it. Also, explain the tuples used in the design of Turing Machine with example. **6**

b) Explain the following : **3+4**

i) Working of Linear Bounded Automata.

ii) Universal Turing Machine.

OR

8. a) Explain the 5 – tuples of counter machine and construct a counter machine for the language $M = \left\{a^m y^m \text{ where } m >= 1\right\}$. **5**

b) Explain the context – sensitive languages. And comment on "If L is a context – sensitive language, then L is accepted by a Linear bounded automaton". **8**

9. a) Explain the term "undecidability of problem" in Turing Machine. **5**

b) Explain the following related to Turing Machine. **8**

i) Halting problem of Turing Machine.

ii) Empty tape problem of Turing Machine.

OR

10. a) Calculate the value of A (3, 4) using Ackermann's function. **5**

b) What is the used of PCP? Does PCP has solution for the given lists : **8**

i) C = (10, 1110, 11)
D = (0, 111, 100)

ii) $\left\{\left(m^3, nm^2n\right), \left(m^3, nm^2n^1\right)\right\}$

11. a) Explain the following basic and complex primitive recursive functions with example of each: **8**

i) Zero function

ii) Successor function

iii) Projection function

iv) Composition

b) Show that the function f is a primitive recursive function. **6**

$f(x, y) = x^y$

OR

12. a) Explain the following with suitable example : **8**

i) TURING – COMPUTABLE functions.

ii) μ - recursive function

b) Write a short note on (any one) **6**

i) bounded minimalization and

ii) unbounded minimalization.

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