

B.Sc. (Honours) Examination, 2019
Semester-V (CBCS)
Computer Science
Course : CC-12
(Theory of Computation)

Time : 3 Hours

Full Marks : 60

Questions are of value as indicated in the margin
 Answer Question No. **1** and **any five** from the rest

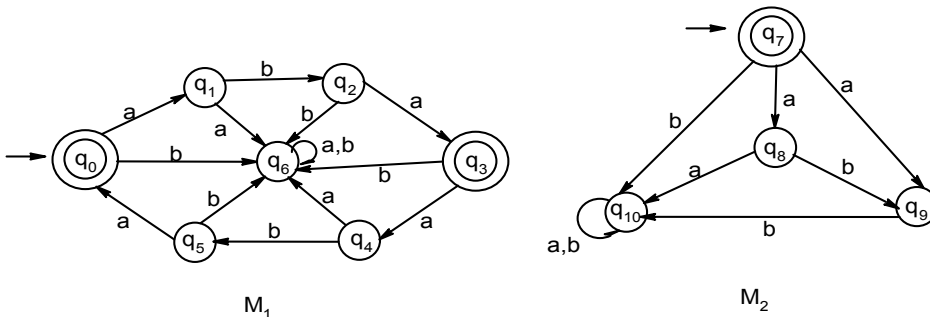
1. Answer **any four** from the following:

5×4=20

- a) Distinguish between Moore machine and Mealy machine. Convert the following Mealy machine into its equivalent Moore machine.

Present State	Next State			
	a = 0		a = 1	
	State	output	State	output
→q ₁	q ₂	z ₁	q ₃	z ₁
q ₂	q ₂	z ₂	q ₃	z ₁
q ₃	q ₂	z ₁	q ₃	z ₂

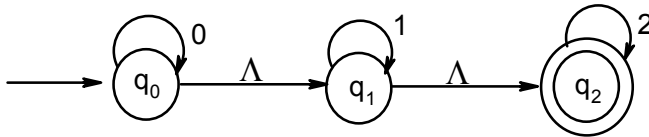
- b) State and prove Arden's Theorem.
 c) Write the algorithm to remove variables from a context free grammar that do not derive any terminal strings.
 d) Show that the set $L = \{a^{i^2} \mid i \geq 1\}$ is not regular.
 e) Define the following :
 i) Yield of a derivation tree.
 ii) ID of a push down automata.
 iii) IID of a Turing machine.
 iv) Regular grammar.
 v) Chomsky Normal form.
2. a) Find whether the two DFA's M_1 and M_2 are equivalent or not.



- b) Consider $\Sigma = \{a, b, c, d, e\}$. What is the number of strings in Σ^* of length 4 such that no symbol is used more than once?
 5+3=8

P.T.O.

3. a) Find the NFA after removing the Λ -moves from the following NFA:



- b) Write a PDA which accepts the language

$$L = \{a^n b^n; n > 0\}$$

4. a) Consider the transition table of NFA, M as follows.

$$4+4=8$$

M State \	a	b
→ (q ₀)		q ₁ , q ₂
q ₁		q ₀
→ (q ₂)	q ₀ , q ₁	

Find the equivalent DFA.

- b) Draw the transition diagram for both the NFA and the DFA obtained above.
5. a) Construct a DFA with reduced states equivalent to $(a+bb)a^*b+ba$. 5+3=8
- b) Construct a regular grammar generating the regular set represented by $P = 0^* 1 (0+1)^*$.
6. a) What do you mean by an ambiguous grammar? Give a suitable example. 4+4=8
- b) Reduce the following grammar into Chomsky Normal form:
- $$S \rightarrow 0A1B \quad A \rightarrow 0A \mid 0 \quad B \rightarrow 1B \mid 1$$
7. a) Consider the following productions:
- $$S \rightarrow aB \mid bA \quad A \rightarrow aS \mid bAA \mid a \quad B \rightarrow bS \mid aBB \mid b$$
- 6+2=8
- Find left most derivation, right most derivation and parse tree for the string *aaabbabbba*.
- b) Can you conclude whether the above grammar is ambiguous or not?
8. a) Design a Turing machine, M, to recognize the language $\{1^n 2^n 3^n \mid n \geq 1\}$. 5+3=8
- b) Draw the transition systems recognizing
- i) $R = \Lambda$ ii) $R = \emptyset$ iii) $R = a$