VIT
Vellore Institute of Technology

Reg. No. :

Final Assessment Test (FAT) - November/December 2023

Programme	B.Tech.	Semester	FALL SEMESTER 2023 - 24
Course Title	THEORY OF COMPUTATION	Course Code	BCSE304L
Faculty Name	Prof. Sathyarajasekaran K	Slot	F1+TF1
		Class Nbr	CH2023240101108
Time	3 Hours	Max. Marks	100

PART-A (10 X 10 Marks)
Answer all questions

01. Construct an equivalent Deterministic Finite Automata for the Non-Deterministic Finite Automata with null moves represented in Figure 1. [10]

M= ({1,2,3,4,5,6,7,8,9}, {a,b,e}, starting state 1, final states 8,9).

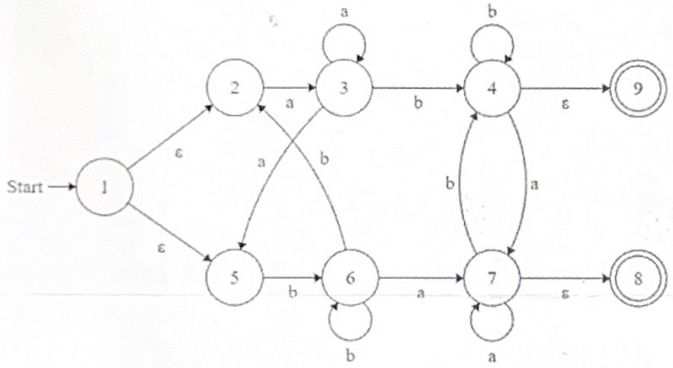

Figure 1

02. [10]

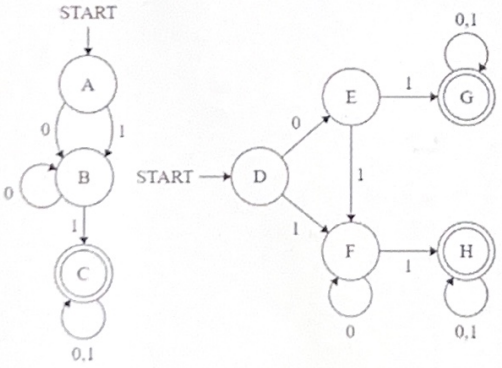

Figure 2: M1

Figure 3: M2

a) Using the equivalence method check whether the two given finite automata M1 & M2 are equal or not. (5 Marks)

b) Let $\sum = \{0,1\}$. Design regular expression to represent the language containing the set of all strings in $\sum^*$ having no more than three 0's or the strings with the number of 1's divisible by two. (2 Marks)

c) For the regular expression in **2(b)** design a Non-Deterministic Finite Automata. (3 Marks)

03. Construct the Context Free Grammar for the following language, [10]

a) L_1= {PQ | where P ∈{a,b}* and Q ∈{c,d}*, where P has an odd length of string and Q has an even length of string. (5 Marks)

b) L_2= {$a^i b^{2i} c^{2j} d^k e^{j+k}$, where i,j,k>0}. (5 Marks)

04. L= {ba $(ab)^{2n}$ ba $(ab)^n$ ba | n ≥1} [10]

Fit the language in Chomsky's class of hierarchy and design an automata to justify the same.

05. Check whether the following language is Context Free Language or not. [10]

a) L1 = {$a^n b^m c^n d^m$, where n, m>0}. (5 Marks)

b) L2 = {$a^n b^m$ | n > 0, m is prime}. (5 Marks)

06. a) Design a Deterministic Finite Automata, M for the language that accepts the numbers which are divisible by 3, where the numbers are taken in binary representation. (4 Marks) [10]

b) For the DFA designed in **6(a)** construct the regular expression R with proof. (6 Marks)

07. A girl collects three different shells from the seashore and arranges them in an order where blue colour comes first followed by red colour and finishes in green colour, the count of red colour shell and green colour shells may not be equal but the count of blue shells should be the total count of red and green shells. [10]

For the above given scenario construct a Context Free Grammar in Greibach Normal Form.

08. S→ABC [10]

A→aA | a

B→bB | b

C→cC | c

Construct the above grammar G into a suitable form and validate the string **aabbcc** using the CYK algorithm.

09. Is the language L = {$a^{2m}b^n c^m d^{2n}$ | n, m>0} decidable? Justify your answer. [10]

10. State whether the instances of the Post Correspondence Problem (PCP) have a solution. The following are the instances with ∑={a,b} [10]

Index	List A	List B
1	ab	ba
2	abb	bba
3	abb	ba
4	aaa	aa
5	ab	aba

In case the PCP has a solution, describe the post-correspondence solution with justification.