Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	B.Tech	Semester	Winter Semester 2022-23
Course Title	THEORY OF COMPUTATION	Course Code	BCSE304L
Faculty Name	Prof. Kiruthika S	Slot	B2+TB2
		Class Nbr	CH2022235001296
Time	3 Hours	Max. Marks	100

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

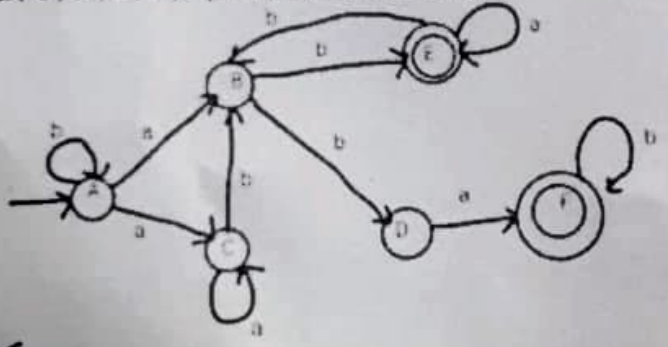
Q1. Consider the regular expression R given below [10]

$1^* + 10^*1^*0$

a) Design a finite automaton that accepts L(R) [5 marks]

b) Construct a regular grammar that generates all strings in L(R) [5 marks]

Q2. Construct an equivalent deterministic finite automaton for the non-deterministic automaton ({A, B, C, D, E, F}, {a, b}, δ, A, {E, F}) given below. [10]



Q3. [10]

Let,

$W_{(i,j)} = A_i B_j, \forall i > 0, j > 0$

where,

$A_0 = ab$

$A_i = (ab)^{|A_0|+(i-1)}$

$B_j = c^{2j}$

|A| is the length of the string A.

a. Generate the language L using $W_{(i,j)}$. [3 marks]

b. Construct a finite state automaton to recognize L. [7 marks]

Q4. Propose a regular expression 'r' with nine operators such that [10]

a. Three operators should be concatenation (.)

b. Three operators should be closure (*)

c. Three operators should be union (+)

d. No two consecutive operators should be the same.

i) Compute L(r). Choose an appropriate Σ for the purpose. [3 marks]

ii) Design a finite automaton to recognize L(r). [7 marks]

Q5. Consider the context-free grammar G given below: [10]

S→AaA | CA| BaB

A→aaBa | CDA |aa | DC

B→bB | bAB |bb | aS

C→Ca | bC |D

D→bD | ε

Construct an equivalent grammar G' which is in Chomsky Normal Form.

06. Check whether the given grammar is ambiguous or not using the string. [10]

"IF x = 0 THEN IF y = 0 THEN z := 1 ELSE w= 2"

Start → Stmt

Stmt → Ifstmt | Astmt

Ifstmt → IF LogExp THEN Stmt | IF LogExp THEN Stmt ELSE Stmt

Astmt → Id = Digit

Digit → 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

LogExp → Id = 0

Id → a | b | c | d | e | f | g | h | i | j | k | l | m | n | o | p | q | r | s | t | u | v | w | x | y | z

The Non-Terminals are {Start, Stmt, Ifstmt, Astmt, Digit, LogExp, Id}

The Terminals are: {IF, THEN, ELSE, 0-9, a-z}

07. Consider the computable function. [10]

f(x) = 4x-1

where x is a positive integer and in unary format.

a. Design a Turing machine that the given function f(x). [7 marks]

b. Give the instantaneous description for the input string "1111111" [3 marks]

08. In a mango juice manufacturing company, a robotic machine pack mangoes in boxes. Each box should contain both yellow and green mangoes. The machine first places the yellow mangoes followed by the green ones. The machine is not programmed to place the mangoes in any other order. It seals the box, only if the number of yellow mangoes exceeds the green ones. Else the box is rejected by the machine. [10]

a. Define the context-free language for the above scenario. [4 marks]

b. Design a pushdown automaton that accepts strings in L [6 marks]

09. Design a Turing machine to sort strings of 1s and 0s. The Turing machine starts scanning the leftmost symbol of an unbroken block of mixed 0s and 1s, which halts after scanning the leftmost symbol of the block rearranged with all the 0s to the left of the 1s. [Hint: If the Input String in the tape is 1010011 then, Output String should be 0001111] [10]

10. Do the following dominoes have a match in the Post correspondence problem (PCP)? [10]

Σ = {0, 1}; P = { [0/00], [011/01], [1/11], [0/0001], [00 /0], [100/00] }