BCA 6TH Semester (Honours) Examination, 2021
BACHELOR OF COMPUTER APPLICATION

Course ID: **Course Code: BCA-601**

Course Title: Theory of Computation

Full Marks: 80 **Time: 4 Hr**

The figure in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group: A

1. **Answer all the questions:** **1X10=10**

i. A shift register is a :
   a. Mealy m/c
   b. Moore m/c
   c. Turing m/c
   d. All of the above
   e. None of the above.

ii. DFA has:
   a. Single final sate
   b. More than one initial states
   c. Unique path to the final state
   d. All of the above.
   e. None of the above

iii. A regular language over an alphabet ∑ is one that can't be obtained from the basic language using the operation___
   a. Union
   b. Concatenation
   c. Kleene*
   d. All of the above
   e. None of the above

iv. Which one is true of the following?
   a. Merger graph is a directed graph
   b. Compatible graph is a directed graph
   c. Both are directed graph
   d. Merger graph has Unique path to the final state
   e. None of the above

v. A grammar with more than one parse tree is called_____
   a. Unambiguous
   b. Ambiguous
   c. Regular
   d. NPDA
   e. None of the above

vi. In FSM diagram what does circle represent?
   a. Change of states
   b. States
   c. O/P value
   d. Initial State
   e. None of the above

vii. If L_1 and L_2 are context free language, which of the following is true?
   a. L_1*
   b. L_2UL_1
   c. $L_1.L_2$
   d. All of the above
   e. None of the above

viii. Regular Expression x/y denotes the set _____
   a. {x, y}
   b. {x y}
   c. {x}
   d. {y}
   e. None of the above

ix. Which of the following strings is not generated by the following grammar? S→ SaSbS|ε
   a. aabb
   b. abab
   c. aababb
   d. aaabbb
   e. None of the above

x. Number of states requires to accept strings with length of 3_____
   a. 3
   b. 4
   c. 5
   d. Can't be represented
   e. None of the above.

Group: B

2. Answer any Ten questions: **2X10=20**

i. Define DFA.
ii. What do you mean by unit production?
iii. What is language?
iv. Regular languages are all context free- Justify.
v. What do you mean by acceptability of a string? Explain.
vi. What are the operations for regular expression?
vii. What is Mealy machine?
viii. What do you mean by right linear grammar?
ix. What do you mean by ∑*?
x. Define complement of a language.
xi. Define error state in the context of FA.
xii. Define synchronous sequential circuit.
xiii. What is Grammar?

xiv. Define NPDA.

xv. L= {a,aa,aaa,aab,.....} over ∑ {a, b}. Is it possible to design a DFA for L? Explain.

Group: C

3. Answer any Four questions: 5X4=20

i. State Pumping lemma for regular language.

ii. Show that the Union of two context free language is context free.

iii. Design a PDA for the language L = {ww^R: w Є{0,1}*} .

iv. Prove that L= {a^P: P is prime} over ∑ {a} is not regular.

v. What is the basic difference between Mealy and Moore machine? Construct a Mealy machine which is equivalent to the Moore machine given below: 2+3

PS	X=0	X=1	Z
q_0	q1	q2	1
q_1	q_3	q_2	0
q_2	q2	q_1	1
q_3	q0	q_3	1

vi. Let G be the grammar S → aB|ba, A → a|aS|bAA ,B → b| bS| aBB, for the string aaabbabbba find.

a. Left most derivation

b. Right most derivation

c. Parse tree

Group: D

4. Answer any Three questions: 10X3=30

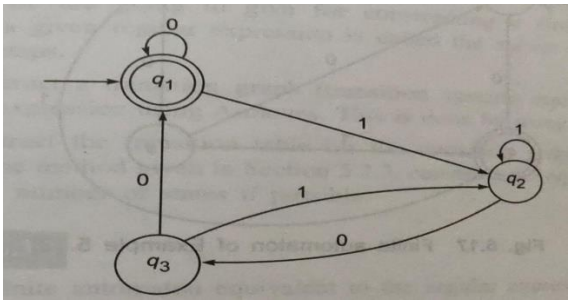
i. Draw the merger graph, merger table, compatibility graph and then minimize the following machine: 4+4+2

PS	I_0	I_1	I_2	I_3
A	_	C,1	E,1	B,1
B	E,0	_	_	_
C	F,0	F,1	_	B,1
D	_	_	B,1	_
E	_	F,0	A,0	D,_
F	C,_	_	B,0	C,1

ii. a. State the difference between DFA & NFA.

b. Design a DFA which accepts set of all binary string contains 1100 or 1010 as substrings.

c. Construct a regular expression corresponding to the state diagram describe by following figure: 2+3+5



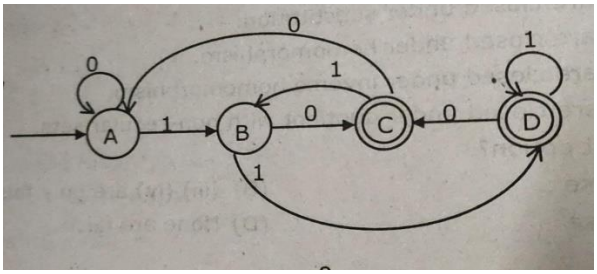
iii. a. Construct PDA accepting the set of all string over {a,b} with equal number of a's & b's.

b. Using Pumping Lemma prove that the set L= $\{0^i 1^i \mid i>1\}$ is not regular. 6+4

iv. a. Construct the minimum state automata equivalent to given automata defined below: (*q_2 indicate that q_2 is the final state)

PS	a	b
→q_0	q_5	q_1
q_1	q_2	q_6
*q_2	q_2	q_0
q_4	q_5	q_7
q_5	q_6	q_2
q_6	q_4	q_6
q_7	q_2	q_6

b. Convert the following NFA to DFA: 6+4



v. a. What do you mean by a sub tree of a derivation tree?

b. Write the CFG for the language L =$\{0^i 1^j 2^k \mid$ i=j or j=k$\}$ 2+5+3

c. E → E+E |E*E| a. Prove that the CFG with this production rule is ambiguous.

vi. a. A long sequence of input pluses enters a two input, two output synchronous sequential circuit, which is required a produced an output Z=1, whenever a sequence 010101 occurs, overlapping sequence are accepted. Draw the state transition diagram.

b. Define inverse machine. 8+2
