

**BCA 4TH Semester (Honours) Examination, 2022
BACHELOR OF COMPUTER APPLICATION**

Course ID: 43313

Course Code: CC-10

Course Title: Theory of Computation

Full Marks: 50

Time: 2 Hr

The figures in the right hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Group: A

1. Answer all the questions: **1x10=10**

- i. Which one of the following statement is false?
 - a. Context free language are closed under union
 - b. Context free language are closed under concatenation
 - c. Context free language are closed under intersection
 - d. Context free language are closed under Kleene Closure
 - e. None of the above
- ii. Which of the following regular identity is true?
 - a. $r^* = r^*$
 - b. $(r^*s^*)^* = (r + s)^*$
 - c. $(r+s)^* = r^* + s^*$
 - d. $r^*s^* = r^* + s^*$
 - e. None of the above
- iii. Which of the following string is not generated by the following grammar S-
 $S \rightarrow SbS \mid e$?
 - a. aabb
 - b. abab
 - c. aababb
 - d. aaabb
 - e. None of the above
- iv. A language L is accepted by a FSA iff it is-
 - a. CFL
 - b. Regular
 - c. Recursive
 - d. CSL
 - e. None of the above.
- v. Let $S = \{a, b, c, d, e\}$. The number of the string in S^* of length 4 such that no symbol is used more than once in a strings is-
 - a. 360
 - b. 35
 - c. 120
 - d. 36
 - e. None of the above.

- vi. The set of all strings over the alphabet $S = \{a, b\}$ including e is denoted by
- $(a+b)^*$
 - $(a+b)^+$
 - $a+b^+$
 - a^*b^*
 - None of the above.
- vii. A. $\{0^n | n \text{ is a prime}\}$
 B. The set of all strings that do not have 3 consecutive 0's.
 Which of the above language is/are regular set?
- Only A
 - Only B
 - Both
 - Can't be determined
 - None of the above.
- viii. Pick the odd one out:
- Right linear grammar
 - Left linear grammar
 - DFA
 - Moore Machine
 - None of the above
- ix. The transition a Push down automata makes is additionally dependent upon the:
- Stack
 - Input tape
 - Output tape
 - Terminals
 - None of the above.
- x. In the Mealy Machine the O/P depends upon:
- State
 - Previous state
 - State/ Inputs
 - Only inputs
 - None of the above.

Group: B

2. Answer any Five questions:

2x5=10

- What is the difference between the alphabet and an element of a set? Whether alphabet is an element of a set or it is a set itself?
- What is a parser?
- Define Complete Binary tree. Give an example of a binary tree with seven vertices.
- Define PDA.
- Define induction principal.
- What is Arden's Theorem?

- vii. What is: (i) $(0+1+0)^*$ (ii) $(01)^*$
viii. What are the applications of automata theory?

Group: C

3. Answer any Four questions: 5 x 4 = 20

- i. Prove that the number of leaves in a binary tree T is $(n+1)/2$, where n is the number of vertices. What do you mean by prefix of a string?
ii. What is the closure property of regular sets? What is the language generated by the grammar $G=(V, T, P, S)$ where $P=\{S- aSb, S- ab\}$?
iii. What is basic difference between the Mealy machine and Moore machine?
Construct a Mealy machine Which is equivalent to a Moore machine given below:

PS	NS		Z
	X=0	X=1	
q ₀	q ₁	q ₂	1
q ₁	q ₃	q ₂	0
q ₂	q ₂	q ₁	1
q ₃	q ₀	q ₃	1

- iv. Consider the grammar $P=\{S- aS \mid aSbS \mid \epsilon\}$ is ambiguous by constructing:
(a) Two parse trees (b) Two left most derivation (c) Rightmost derivation
v. Is the following machine information lossless? If yes, then find the looselessness.

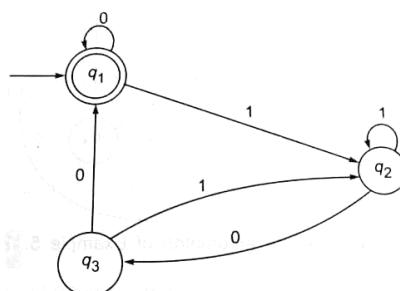
PS	NS	
	X=0	X=1
A	A,0	B,0
B	C,0	D,0
C	D,1	C,1
D	B,1	A,1

- vi. Construct a grammar generating $L= \{wcw^T | w \in \{a, b\}^*\}$. What do you mean by transition system?

Group: D

4. Answer any One questions: 10x1=10

- i. A. Show that the set of all non palindromes over $\{a, b\}$ is a context free language.
B. Construct a regular expression corresponding to the state diagram described below. 5+5



- ii.
- A. State pumping lemma.
 - B. Draw the DFA over $\Sigma = \{a, b\}$, Set of all binary string with length of strings divisible by 3.
 - C. Construct a pda A accepting the set of all strings over $\{a, b\}$ with equal number of a's and b's.
 - D. What do you mean by acceptability of a string by a FA? 2+2+4+2=10
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