Roll No. ……..

BCA–C402

Bachelor of Computer Applications

(Fourth Semester)

EXAMINATION, 2022-23

THEORY OF COMPUTATION

Time : $2\frac{1}{2}$ Hours

Maximum Marks : 60

Note : All questions have to be attempted.

Section—A

1. Multiple choice questions : 1 each

(a) The set of all strings over the alphabet S = $\{a, b\}$ is denoted by : (CO1, BL-1)

(i) $(a + b)^*$

(ii) $(a + b)^+$

(iii) $(a + b)^-$

(iv) $a^* b^*$

(b) Which of the following regular expression identity is true ? (CO2, BL-2)

(i) $r(*) = r*$

(ii) $(r*s*) = (r+s)^*$

(iii) $(r+s)^* = r^* + s^*$

(iv) $r^*s^* = r^* + s^*$

(c) The logic of pumping lemma is a good example of : (CO4, BL-3)

(i) Pigeon-hole principle

(ii) Recursion

(iii) Iteration

(iv) Divide and Conquer technique

(d) Context free grammar is recognized by ? (CO4, BL-2)

(i) FA

(ii) PDA

(iii) TM

(iv) Both (i) and (ii)

(e) Context free language is closed under ? (CO3, BL-3)

(i) Union

(ii) Complement

(iii) Intersection

(iv) None of the above

(f) The intersection of CFL and RL : (CO3, BL-4)

(i) is always regular

(ii) is always context free

(iii) Both (i) and (ii)

(iv) Need not be regular

(g) The language L= $\{0^n1^n2^n \text{ where } n > 0\}$ is a : (CO4, BL-4)

(i) Context free language

(ii) Context Sensitive language

(iii) Regular language

(iv) Recursive language

(h) Minimum number of stack is required for implementing finite state machine : (CO5, BL-2)

(i) 0

(ii) 1

(iii) 2

(iv) 3

(i) The minimum number of states required to recognize an empty string over alphabet $\Sigma = \{a, b\}$? (CO2, BL-1)

(i) 0

(ii) 1

(iii) 2

(iv) 3

(j) Number of minimum states require to accept string ends with 001 over $\Sigma = \{0,1\}$ in DFA ?

(CO3, BL-4)

(i) 3

(ii) 2

(iii) 1

(iv) 4

(k) Which of the function can a turing machine not perform ? (CO5, BL-3)

(i) Copying a string

(ii) Deleting a symbol

(iii) Accepting a palindrome

(iv) Inserting a symbol

(l) The language accepted by Push Down Automata ? (CO5, BL-2)

(i) Context free language

(ii) Regular language

(iii) Both (i) and (ii)

(iv) Recursive language

Section—B

2. Attempt any *four* of the following : 3 each

(a) Write the difference between DFA and NFA.

(CO2, BL-3)

(b) Construct a DFA that accepts a language L which has the number of zero's is of multiple of 3 over an alphabet $\Sigma = \{0,1\}$. (CO2, BL-3)

(c) Construct a minimal DFA to accept a string over alphabet $\Sigma = \{a,b\}$. Which ends with "aba". Also create transition table and validate the machine with sample inputs. (CO3, BL-2)

(d) State and prove the pumping lemma for regular language. (CO2, BL-3)

(e) Define ambiguous grammar. Show that the following grammar is ambiguous : (CO3, BL-5)

$$S \rightarrow aSbS/bSaS/ \in (\text{epsilon})$$

3. Attempt any *two* questions : 6 each

(a) Obtain the left and right derivation for a string $w = 001122$ for the production rules :

(CO3, BL-5)

$$S \rightarrow AB,\ A \rightarrow O1/OA/,\ B \rightarrow 2B/ \in (\text{epsilon})$$

(b) Prove that regular language is closed under intersection and union. (CO4, BL-4)

(c) Explain the block diagram of PPA with its components specification. (CO4, BL-3)

4. Attempt any *two* questions : 6 each

(a) Convert the following NFA into DFA : (CO2, BL-3)

(b) The state diagram for Moore Machine is given as follow : (CO4, BL-6)

(i) Draw the transition table for Moore machine.

(ii) Find the output for the input string 011011010

(c) Discuss the Chomsky hierarchy of grammar with suitable examples. (CO3, BL-6)

5. Attempt any *two* questions. 6 each

(a) Obtain regular expression from the given finite automata : (CO4, BL-3)

(b) Convert the following grammar to CNF form :

(CO5, BL-5)

$S \rightarrow A/ABO/AIA$, $A \rightarrow AO/C$

$B \rightarrow BI/BC$, $C \rightarrow CB/CA/IB$

(c) Define PCP and prove that PCP is undecidable.

(CO4, BL-6)