

Registration No:

II In-Semester Examination November 2024
B.Tech CSE V Sem. (Common for all specialization except TCS)
Subject: Formal Languages & Automation Theory
Subject Code: CO 017A

Maximum Marks: 40

Time: 1.30 hr.

CO3: Construct pushdown automata and the equivalent context free grammars.
CO4: Prove the equivalence of languages described by pushdown automata and context free grammars.

(2*2=4 Marks)

Section - A (Very Short answers)

- (CO3) Q1. G is $S \rightarrow aS|bS|a|b$ Find $L(G)$
(CO4) Q2. Explain block diagram of push down automata.

(7*2=14 Marks)

Section - B (Short answers)

- (CO3) Q1. (A) If $G = (\{S, C\}, \{a, b\}, \{S \rightarrow a^i b^j c^k, i \geq 1, j \geq 0\}, S)$, Find $L(G)$.
(CO3) Q1. (B) Consider the production rules of grammar G. Prove $L(G) = \{a^n b^m \mid m > n, n \geq 0\}$ is Generated by $G = (\{S, A, B\}, \{a, b\}, S \rightarrow AbB, A \rightarrow aAb \wedge, B \rightarrow bB \wedge, S)$
(CO4) Q2. Explain PDA and its operation. Construct the PDA for the following languages.
 $\{wcw^R \mid w \in (0+1)^+\}$

(11*2=22 Marks)

Section - C (Long Answers)

- (CO3) Q1. (A) Define ambiguous grammar. Check Is Grammar ambiguous? $S \rightarrow SbS/a$
(CO3) Q1. (B) Find a grammar in Chomsky normal form equivalent to-
 $S \rightarrow aAbB, A \rightarrow aA|a, B \rightarrow bB|b$.
(CO4) Q2. (A) Explain PDA and its operation. Construct the PDA for the following languages.
 $\{1^n 2^{n+m} 3^m \mid n \geq 1, m \geq 1\}$
(CO4) Q2. (B) Construct a PDA equivalent to the following CFG: $S \rightarrow 0BB, B \rightarrow 0S|1S|0$. Test whether 010^4 is in $N(A)$.

also Explain
type of:

1. Answer the following questions.
2. Answer the questions with suitable examples and diagrams, wherever necessary.
3. Refer to questions numbers before writing the answers.
4. Construct finite state machines and the equivalent regular expressions.
5. Prove the equivalence of languages described by finite state machines and regular expressions.
6. Construct pushdown automata.
7. Prove the equivalence of languages described by pushdown automata and context free grammars.
8. Construct Turing machines and Post machines and prove the equivalence of languages described by Turing machine and Post machines.

SECTION-A (2 marks each)

1. Let R be any set of regular languages. Is UR regular? Prove it. [CO1]
2. What are the properties of Transition Function (δ)? [CO2]
3. Construct a DFA for the regular expression aa^*bb^* [CO3]
4. Construct a FA which checks whether the given binary number is even [CO4]
5. Are some languages not decidable or even Turing-recognizable? [CO5]

(10 marks)

SECTION-B (7 marks each)

1. Construct a finite automata for the regular expression $(0+1)^*(00+11)(0+1)^*$. [CO1]
2. What do you mean by the Chomsky Hierarchy in the formal language theory? Convert the given CFG into GNF S-
AB, A \rightarrow BS | 1.B \rightarrow SA | 0 [CO2]
3. Rewrite the following grammar after eliminating useless symbols S \rightarrow AB | DS

Dd/E
a [CO3]

4. Convert the following NFA into equivalent DFA without epsilon transitions.

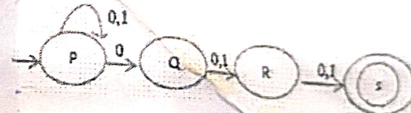


5. Construct a PDA that accepts the strings of language $L = \{ ww^R \mid w \text{ is in } \{a,b\}^* \}$.

SECTION-C (11 marks each)

(55 marks)

1. Construct the PDA accepting the language $L = \{ (ab)^n \mid n \geq 1 \}$ by empty stack.
2. $L = \{ a^n b^n \mid n \geq 1 \}$ Trace your PDA for the input with $n=3$.
3. $L = \{ ww^R \mid w \text{ is in } \{a+b\}^* \}$
4. $L = \{ 0^n 1^{2n} \}$ by empty stack.
5. $L = \{ ww^R \mid w \text{ is in } \{0+1\}^* \}$ [CO1]
6. (i) Write Regular expression for the following: $m=2, n=2$
(ii) Write DFA to accept strings of 0's, 1's & 2's beginning with a 0 followed by 1's and ending with a 2. [CO2]
7. Convert the following CFG into Normal Form.
 $S \rightarrow AaA, BbB$
 $A \rightarrow AaA, BbB$
 $B \rightarrow BbB, AaA$
8. Show that language of palindrome over $\{a,b\}$ is not a regular language. [CO3]
9. (i) How a NFA can be converted into a DFA? Convert the following NFA into equivalent DFA. [CO4]



(ii) What is the difference between Mealy and Moore machine?

5. Explain the different types of Turing Machine. Design a Turing Machine for the language of all strings over the alphabet $\Sigma = \{a,b\}$ whose second symbol is 'a'.

Multi
Non Multi
deterministic