office copy (2) First Floor f108

Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

B E- COE, CSE (VI Semester) EST	Course Code: UCS701 Course Name: Theory of Computation
June 2, 2022 8:00	
Time: 2 Hours, M. Marks: 35	Name Of Faculty: Sunita Garhwal, Chinmaya Panigrahy, Avadh Kishor, Gaurav Pareek, Shashank Sheshar, Nitigya Sambyal

Note: Attempt all questions with proper justification. Assume missing data, if any, suitably.
All questions carry equal weightage.

Q.1(a) Given the grammar G=({S}, {a}, {S→ $aS \mid Sa \mid a$}, S). Draw all possible derivation tree for the string w=aaa. Also determine whether the grammar is ambiguous or not. Give reasoning for the same. (3)

Q1(b) Consider the following grammar and convert it into equivalent GNF grammar. (4)

S→ $AA \mid 0$

A→ SS | 1

Q2(a) Draw the flowchart for the language L={$a^n b^{m+n} c^m$ | n, m ≥0}. Write down the transition diagram for the above designed flowchart. (4)

Q2(b) Prove that context-free languages are not closed under complementation. (3)

Q3 (a) Construct a context-free grammar over {0,1} which generates all strings with equal number of 0's and 1's (Few accepted strings for example 0110, 1010, 001110,...}. Justify your answer. (3)

Q3(b) Prove that L={ww | w is any string over {0,1}} is not a context-free language using Pumping Lemma. (4)

Q4(a) Consider the context-free grammar: (3)

S→ ABA

A→ $aA \mid \varepsilon$

B→ $bB \mid \varepsilon$

Convert the Context-free grammar into Chomsky Normal Form.

(P.T.O.)

Q4(b) Given the context-free grammar (4)

$S \rightarrow XY$

$X \rightarrow 0 \mid YY$

$Y \rightarrow 1 \mid XY$

Apply CYK algorithm to determine whether the string *w=00111* belongs to the language generated by above given grammar.

Q5(a) Write down the logic for design of a Turing machine for the language $L_{Rev}=\{wcw^r \mid w \text{ is any string over } \{a, b\} \text{ and } w^r \text{ denotes reverse of } w\}$. (2)

Q5(b) Design the Turing Machine for L_{Rev}. (3)

Q5(c) Give the trace/ Instantaneous description for the string w=abbcbba (2)

**********End of Paper**********

Roll Number: _____ Name: ..... Group :.....

Thapar Institute of Engineering and Technology

Department of Computer Science and Engineering

B E- COE, CSE (VI Semester) Quiz 2 — Course Code: UCS701

Course Name: Theory of Computation

June 2, 2022 8:00 A.M. — Time: 10 Mins Max Marks: 10

Note: Attempt all questions with proper justification. Assume missing data, if any, suitably. **In case you think no option is correct write option (e).**

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10

1. Consider the grammar: $S \rightarrow aSAb \mid \varepsilon;\ A \rightarrow bA \mid \varepsilon$; The grammar generates strings in the form $a^n b^m$ for some $n, m \geq 0$. What are the conditions for m & n?

   a) $m = n$ b) $m > 2n$ c) $m \geq 2n$ d) $m \geq n$

2. Which of the following languages is accepted by a non-deterministic pushdown automata (PDA) but not by a deterministic PDA

   a) $\{a^n b^n c^n \mid n \geq 0\}$
   b) $\{a^l b^m c^n \mid l \neq m \text{ or } m \neq n\}$
   c) $\{a^n b^n \mid n \geq 0\}$
   d) $\{a^m b^n \mid m, n \geq 0\}$

3. Consider S → SS | a. What is the number of different derivation trees for w = aaaaa

   a) 3 b) 5 c) 7 d) 14

4. A Pushdown machine behaves like a Turing machine when the number of auxiliary memory it has is:

   a) 0 b) 1 or more c) 2 or more d) None of these

5. What is the minimum number of productions needed to add the below-given context-free grammar to make it Greibach normal form?

   $$\boldsymbol{S \rightarrow aSb \mid ab}$$

   a) 2 b) 3 c) 1 d) 0

6. If a context-free grammar G, is in CNF form (productions are of the form $A \rightarrow BC$ or $A \rightarrow a$). How many times the productions of the form $A \rightarrow BC$ have to be applied in the derivation of the string of length 5?

   a) 6 b) 5 c) 4. d) 3

7. If G is a CFG in CNF form and w belongs to L(G). How many steps are needed to derive w of length n?

   a) 2n b) 2n+1 c) 2n-1 d) 2^n

8. What is the minimum number of states required for the Turing Machine to accept strings with an even number of 1's.
   a) 5 b)1 c) 2 d) 4

9. Which of the following pairs have different expressive power?
   a) Deterministic Finite Automata and Non-Deterministic Finite Automata
   b) Deterministic Push Down Automata and Non-Deterministic Push Down Automata
   c) Deterministic Turing Machine and Non-Deterministic Turing Machine
   d) Single-Tape Turing Machine and Multi-Tape Turing Machine

10. Consider the languages: $L_1=\{a^nb^nc^m \mid n, m>0\}$ and $L_2=\{a^nb^mc^m \mid n, m>0\}$
Which of the following statements is false?
   a) $L_1 \cap L_2$ is Context free
   b) $L_1 \cup L_2$ is Context free
   c) Both L_1 and L_2 are Context free
   d) All of the above