LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **COMPUTER SCIENCE**

THIRD SEMESTER – **NOVEMBER 2022**

PCS 3301 – THEORY OF COMPUTATION AND COMPILER DESIGN

Date: 11-30-2022 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

Part – A

Answer ALL the questions **(10 × 2 = 20 marks)**

1. What is a recursive function?
2. Differentiate finite set from infinite set. Give examples.
3. Define a NDFA.
4. Construct a DFA that accepts all positive integers multiples of 5.
5. Give a brief note on Turing machine.
6. Why do we need a compiler?
7. What is the role of parser?
8. What is a token?
9. What is frequency reduction?
10. What do you mean by peephole optimization?

Part – B

Answer ALL the questions **(5 × 8 = 40 marks)**

11. a) Write a grammar to generate the set of all strings on {a, b} to produce all palindromes.

(Or)

b) State and prove two associative laws in sets.

12. a) Design a DFA that accepts all positive integers divisible by 3.

(Or)

b) Construct a finite automaton on {0, 1} that accepts all strings not ending with '001'.

13. a) Write notes on halting problem.

(Or)

b) Discuss the types of compiler construction tools.

14. a) Explain bottom-up parsing with example.

(Or)

b) Consider the following grammar

$S \rightarrow aB / bA$

$S \rightarrow aS / bAA / a$

$B \rightarrow bS / aBB / b$

Derive the rightmost derivation and draw the parse tree for the string aaabbabba.

15. a) Explain the basic blocks with example.

(Or)

b). Discuss the flow graph with example.

Part – C

Answer ANY TWO questions **(2 × 20 = 40 marks)**

16. a) Write a detailed account on Chomsky's classification of languages.

b) Design a DFA on {a, b, c} that accepts all strings of length greater than or equal to 9.

(12+8)

17. a) Convert the given NDFA $(Q, \sum, q_0, F, \delta)$ to a FSA where

$Q = \{q_0, q_1, q_2, q_3\}$

$\sum = \{0,1\}$

$F = \{q_3\}$

q_0 is the initial state

Transition function is defined as follows:

$\boldsymbol{\delta}$	**0**	**1**
$\boldsymbol{q_0}$	q_1, q_3	q_1, q_2
$\boldsymbol{q_1}$	q_2	q_2
$\boldsymbol{q_2}$	q_2	q_3
$\boldsymbol{q_3}$	-	q_1, q_2, q_3

b) What is ambiguous grammar? Check whether the following grammar is ambiguous or not for the input string **" 3 * 2 + 5 "**

$E \rightarrow I$

$E \rightarrow E + E$

$E \rightarrow E * E$

$E \rightarrow (E)$

$I \rightarrow \varepsilon \mid 0 \mid 1 \mid 2 \mid ... \mid 9$ **(10+10)**

18. a) Discuss the different types of optimizations.

b) Explain the phases of a compiler with a diagram. **(10+10)**

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