



## NARSIMHA REDDY ENGINEERING COLLEGE

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### FORMAL LANGUAGES AND AUTOMATA THEORY (23CY503)

#### UNIT IV – Normal Forms and Turing Machines

##### Part-A: Short Answer Questions

1. Define Chomsky Normal Form (CNF).
2. Define Greibach Normal Form (GNF).
3. What are Useless Symbols?
4. Define  $\epsilon$ -Productions.
5. State the Pumping Lemma for CFLs.
6. What is a Closure Property of CFL?
7. Define Turing Machine.
8. What is an Instantaneous Description?
9. Define Tape Alphabet.
10. What is a Transition Function in TM?

##### Part-B: Descriptive Questions

1. Explain elimination of useless symbols.
2. Discuss conversion of CFG into CNF.
3. Explain Greibach Normal Form with examples.
4. Discuss the Pumping Lemma for CFLs.
5. Explain closure and decision properties of CFLs.
6. Describe the formal model and working of a Turing Machine.

##### Tutorial Assignment:

Convert a CFG into CNF and GNF.

##### Part-C: MCQs

1. CNF stands for:

- A) Chomsky Normal Form
- B) Context Normal Form
- C) Chained Normal Form
- D) Common Normal Form

2. GNF stands for:

- A) Greibach Normal Form
- B) Grammar Normal Form
- C) General Normal Form
- D) Global Normal Form

3. In CNF, productions are generally of the form:

- A)  $A \rightarrow BC$  or  $A \rightarrow a$
- B)  $A \rightarrow aB$
- C)  $A \rightarrow ABC$
- D)  $A \rightarrow \epsilon$

4. A useless symbol is one that:

- A) Does not contribute to generating strings ✓
- B) Is a terminal
- C) Is a start symbol
- D) Is a production

5.  $\epsilon$ -production is a production of the form:

- A)  $A \rightarrow \epsilon$  ✓
- B)  $A \rightarrow a$
- C)  $A \rightarrow BC$
- D)  $A \rightarrow B$

6. The Pumping Lemma for CFL is used to:

- A) Prove languages are not CFLs ✓
- B) Design DFA
- C) Design PDA
- D) Minimize DFA

7. Context-Free Languages are closed under:

- A) Union ✓
- B) Complement
- C) Difference
- D) None

8. A Turing Machine consists of:

- A) Tape, Head, and Control Unit ✓
- B) Stack only
- C) Queue only
- D) Registers only

9. The memory of a Turing Machine is:

- A) Infinite Tape ✓
- B) Stack
- C) Queue
- D) Register

10. The computational power of a Turing Machine is:

- A) Greater than PDA ✓
- B) Equal to DFA
- C) Less than PDA
- D) None

11. Instantaneous Description represents:

- A) Current configuration of TM ✓
- B) Input only
- C) Output only
- D) State diagram

12. The tape head can move:

- A) Left or Right ✓
- B) Right only
- C) Left only
- D) Up and Down

13. A Turing Machine accepts:

- A) Recursively Enumerable Languages ✓
- B) Regular Languages only
- C) CFL only
- D) None

14. CNF is mainly used for:

- A) Simplifying CFGs ✓
- B) Minimizing DFA
- C) PDA Design
- D) TM Design

15. GNF productions begin with:

- A) Terminal Symbol ✓
- B) Non-terminal
- C)  $\epsilon$
- D) Variable

16. The start symbol is generally represented by:

- A) S ✓
- B) A
- C) X
- D) Z

17. The language accepted by a TM is called:

- A) Turing Language ✓
- B) Regular Language
- C) PDA Language
- D) Finite Language

18. A PDA uses:

- A) Stack ✓
- B) Tape
- C) Queue
- D) Register

19. A Turing Machine is considered:

- A) Universal Computing Model ✓
- B) Finite Machine
- C) Stack Machine
- D) Queue Machine

20. The closure property not generally satisfied by CFLs is:

- A) Complement ✓
- B) Union
- C) Concatenation
- D) Kleene Star

#### Part D: Fill in the Blanks

1. CNF stands for \_\_\_\_\_ Normal Form.

**Answer:** Chomsky

2. GNF stands for \_\_\_\_\_ Normal Form.

**Answer:** Greibach

3. A useless symbol does not contribute to generating \_\_\_\_\_.

**Answer:** Strings

4.  $\epsilon$ -production has the form  $A \rightarrow$  \_\_\_\_\_.

**Answer:**  $\epsilon$

5. CNF simplifies \_\_\_\_\_ grammars.

**Answer:** Context-Free

6. GNF productions start with a \_\_\_\_\_ symbol.

**Answer:** Terminal

7. Pumping Lemma helps prove languages are not \_\_\_\_\_.  
**Answer:** Context-Free
8. CFL stands for \_\_\_\_\_ Free Language.  
**Answer:** Context
9. Context-Free Languages are closed under \_\_\_\_\_.  
**Answer:** Union
10. A Turing Machine contains an infinite \_\_\_\_\_.  
**Answer:** Tape
11. The reading device of a TM is called a tape \_\_\_\_\_.  
**Answer:** Head
12. The current configuration of TM is called \_\_\_\_\_ Description.  
**Answer:** Instantaneous
13. A Turing Machine is more powerful than a \_\_\_\_\_ Automaton.  
**Answer:** Pushdown
14. The tape head can move left and \_\_\_\_\_.  
**Answer:** Right
15. Turing Machines accept \_\_\_\_\_ Enumerable Languages.  
**Answer:** Recursively
16. The start symbol of a CFG is usually represented by \_\_\_\_\_.  
**Answer:** S
17. CNF productions are generally of the form  $A \rightarrow BC$  or  $A \rightarrow$  \_\_\_\_\_.  
**Answer:** a
18. GNF is useful in top-down \_\_\_\_\_.  
**Answer:** Parsing
19. The memory of a PDA is a \_\_\_\_\_.  
**Answer:** Stack
20. Turing Machine is a model of \_\_\_\_\_.  
**Answer:** Computation