CSE303 PRACTICE FINAL
(15 extra points)

NAME **ID:**

Practice Final is DUE LAST DAY OF CLASSES- Friday, May 4
I will be in my office 3-4pm. Please bring it in that time, or to class on Thursday.

FOR FINAL study Practice Final and Problems from $Q1-Q4$, and Midterm.
I will choose some of these problems for your Final.

PART 1: Yes/No Questions Circle the correct answer to ALL questions.
Write ONE-SENTENCE justification to **ten questions**.

1. There are uncountably many languages over $\Sigma = \{a\}$.
   Justify:
   y n
2. Let $\Sigma = \phi$, there is $L \neq \phi$ over Σ.
   Justify:
   y n
3. $L^* = \{w \in \Sigma^* : \exists_{q\in F}(s, w) \vdash_M^* (q, e)\}$.
   Justify:
   y n
4. $(a^*b \cup \phi^*)$ is a regular expression.
   Justify:
   y n
5. Let L be a language defined by $(a^*b \cup ab)$, i.e (shorthand) $L = a^*b \cup ab$. Then $L \subseteq \{a, b\}^*$.
   Justify:
   y n
6. $\Sigma = \{a\}$, there are **c** (continuum) languages over Σ.
   Justify:
   y n
7. For any languages $L_1, L_2, L_3 \subseteq \Sigma^* L_1, \cup (L_2 \cap L_3) = (L_1 \cup L_2) \cap (L_1 \cup L_3)$.
   Justify:
   y n

8. $L^* = L^+ - \{e\}$.
Justify:

y **n**

9. $L = ((\phi^* \cup b) \cap (b^* \cup \phi))$ (shorthand) has only one element.
Justify:

y **n**

10. If M is a FA, then $L(M) \neq \phi$.
Justify:

y **n**

11. If M is a nondeterministic FA, then $L(M) \neq \phi$.
Justify:

y **n**

12. $L(M_1) = L(M_2)$ iff M_1 and M_2 are finite automata.
Justify:

y **n**

13. If L is regular, then there is a finite M, such that $L = L(M)$.
Justify:

y **n**

14. Any finite language is CF.
Justify:

y **n**

15. L_1 is regular, L_2 is CF, $L_1, L_2 \subseteq \Sigma^*$, then $L_1 \cap L_2 \subseteq \Sigma^*$ is CF.
Justify:

y **n**

16. Intersection of any two regular languages is CF language.
Justify:

y **n**

17. Union of a regular and a CF language is a CF language.
Justify:

y **n**

18. $L = \{a^n b^n c^n : n \geq 0\}$ is CF.
Justify:

y **n**

19. If L is regular, there is a PDA M such that $L = L(M)$.
Justify:

y **n**

20. If L is regular, there is a CF grammar G, such that $L = L(G)$.
Justify:

y **n**

21. $A \rightarrow Ax, A \in V, x \in \Sigma^*$ is a rule of a regular grammar.
Justify:

y **n**

22. $L = \{a^n b^n : n \geq 0\}$ is CF.
Justify:

y **n**

23. Let $\Sigma = \{a\}$, then for any $w \in \Sigma^*, w^R w \in \Sigma^*$.
Justify:

y **n**

24. Let $G = (\{S, (,)\}, \{(,)\}, R, S)$ for $R = \{S \to SS \mid (S)\}$. $L(G)$ is regular.
Justify:

y **n**

25. $((p, e, \beta), (q, \gamma)) \in \Delta$ means: read nothing, move from p to q
Justify:

y **n**

26. $L = \{a^n b^m c^n : n, m \in N\}$ is CF.
Justify:

y **n**

27. Class of context-free languages is closed under intersection.
Justify:

y **n**

28. Every subset of a Context Free language is a language.
Justify:

y **n**

29. A parse tree is always finite.
Justify:

y **n**

30. Any regular language is accepted by some PD automata.
Justify:

y **n**

31. Every subset of a regular language is a regular language.
Justify:

y **n**

32. A CF language is a regular language.
Justify:

y **n**

33. A regular language is a CF language.
Justify:

y **n**

34. A parse tree is always finite.
Justify:

y **n**

35. A CF grammar G is called ambiguous if there is $w \in L(G)$ with at least two distinct parse trees.

Justify:

y **n**

36. A CF language L is inherently ambiguous iff all context-free grammars G, such that $L(G) = L$ are ambiguous.
Justify:

y **n**

37. Turing Machines can read and write.
Justify:

y **n**

38. A configuration of a Turing machine $M = (K, \Sigma, \delta, s, H)$ is any element of a set $K \times \Sigma^* \times (\Sigma^*(\Sigma - \{\#\}) \cup \{e\})$, where $\#$ denotes a blanc symbol.
Justify:

y **n**

39. A computation of a Turing machine can start at any position of $w \in \Sigma$. **Justify**:

y **n**

40. Turing Machines are as powerful as today's computers.
Justify:

y **n**

41. It is proved that everything computable (algorithm) is computable by a Turing Machine and vice versa.
Justify:

y **n**

42. Church's Thesis says that Turing Machines are the most powerful.
Justify:

y **n**

PART 2: Problems

QUESTION 1 Given a **Regular grammar** $G = (V, \Sigma, R, S)$, where

$$V = \{a, b, S, A\}, \quad \Sigma = \{a, b\},$$

$$R = \{S \to aS \mid A \mid e, \quad A \to abA \mid a \mid b\}.$$

1. Construct a finite automaton M, such that $L(G) = L(M)$. You can draw a diagram.

2. Trace a transitions of M that lead to the acceptance of the string $aaaababa$, and compare with a derivation of the same string in G.

QUESTION 2 Construct a context-free grammar G such that

$$L(G) = \{w \in \{a, b\}^* : \ w = w^R\}.$$

Justify your answer.

QUESTION 3 Construct a **pushdown** automaton M such that

$$L(M) = \{w \in \{a,b\}^* : \ w = w^R\}$$

Components of M are:

Explain your construction. Write motivation.

Diagram of M is: