CSE303 PRACTICE FINAL Spring 2018
(15 extra pts)

NAME **ID:**

MY POINTS ARE:

TAKE test as a PRACTICE - and **correct it yourself** to see how much points you would get.

Solutions to all problems and questions are somewhere on our webpage! so you CAN correct yourself- but do it **ONLY AFTER you complete it all by yourself**.

This is the **goal** of the PRACTICE TEST!

PLEASE SUBMIT your SOLUTIONS that have been CORRECTED BY YOU - Write corrections in RED. You WILL GET 15 points for THAT! even if all problems you solved were first wrong- and then CORRECTED!

Write a sum of POINTS you give yourself for your solutions - after you check your answers for corrections.

The **real midterm will have less problems**; I will make sure you will be able to complete it within 1 hour and 15 minutes.

BRING YOUR solved-corrected TEST to class on Wednesday, May 2 -Last day of classes, or to my office any day BEFORE May 2

I WILL POST THE SOLUTIONS on May 2 after the class- for you to STUDY for FINAL. I WILL not ACCEPT solutions after Wednesday, May 2.

FINAL is scheduled for **Tuesday, MAY 8, 5:30 -8:00 pm**, in JAVITS 100

1 PART 1 (25pt): Yes/No Questions

Circle the correct answer (each question is worth 1pt) Write SHORT justification.

1. A is uncountable iff $\mid A \mid = \mathbf{c}$ (continuum).
   Justify:

   y n

2. $(ab \cup a^*b)^*$ is a regular language
   Justify:

   y n

3. There are uncountably many languages over $\Sigma = \{a\}$.
   Justify:

   y n

4. $L^* = \{w \in \Sigma^* : \exists_{q \in F}(s, w) \vdash_M^* (q, e)\}$.
   Justify:

   y n

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

y **n**

6. $L^* = \{w_1 \ldots w_n, w_i \in L,\ i = 1, \ldots, n\}$.
Justify:

y **n**

7. $((\phi^* \cap a) \cup (\phi \cup b^*)) \cap \phi^*$ represents a language $L = \{e\}$.
Justify:

y **n**

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

y **n**

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

y **n**

10. A language is regular if and only if $L = L(M)$ and M is a finite automaton
Justify:

y

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

y **n**

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

y **n**

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

y **n**

14. Any finite language is CF.
Justify:

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

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

y **n**

2 PART 2 (120pts)

Each Question is 20pts

QUESTION 1

Let L_1, L_2 be the following languages over $\Sigma = \{a, b\}$:

$$L_1 = \{w \in \Sigma^\star : \exists_{u \in \Sigma\Sigma}(w = uu^R u)\},$$

$$L_2 = \{w \in \Sigma^\star : ww = www\}.$$

1. List elements of $\Sigma\Sigma$

2. Show that L_1 is a finite set

3. Give examples of 2 words w over Σ such that $w \notin L_1$.

4. Show that $L_2 \neq \emptyset$.

QUESTION 2

Let Σ be any alphabet, L_1, L_2 two languages over Σ such that $e \in L_1$ and $e \in L_2$. Show that

$$(L_1 \Sigma^{\star} L_2)^{\star} = \Sigma^{\star}$$

QUESTION 3

Use book or lecture definition (specify which are you using) to construct a non-deterministic finite automaton M, such that

$$L(M) = (ab)^{*}(ba)^{*}.$$

1. Draw the state diagram.

2 Justify your construction by listing some strings accepted by the state diagram.

QUESTION 4 Construct a PDA M, such that

$$L(M) = \{b^n a^{2n} : n \geq 0\}.$$

1. List componenets : $M = (K, \Sigma, \Gamma, \Delta, s, F)$

2. Draw diagram

3. Explain the construction. Write motivation.

4. Trace a transitions of M that leads to the acceptance of the string *bbaaaa*.

QUESTION 5 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. Use the construction in the proof of **L-GTheorem:**

Language L is regular if and only if there exists a regular grammar G such that L = L(G)

to construct a **finite automaton** M, such that $L(G) = L(M)$.

JUST DRAW a **diagram** of M

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

QUESTION 6

Prove that the Class of context-free languages is NOT closed under intersection

EXTRA CREDIT

Use closure under union for CF languages to show that

$$L = \{a^n b^n : \ n \neq m\}$$

is a CF language