

Name: _____

1. (1 pt.)

- **Read all material carefully.**
- This test is **closed book, closed notes**.
- However, you may refer to **one** standard Letter-sized sheet of paper (both sides) that has **notes hand-written by you**. If used, this sheet of notes must **include your name** near the top and must be **submitted** along with this test.
- Computing or communication devices of any kind (laptop computers, tablets, phones, calculators, etc.) are not permitted.
- Network access of any kind (cell, voice, text, data, etc.) is not permitted.
- Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
- Use class and textbook conventions for notation, algorithmic options, etc.

Print your name clearly in the space provided above.

Do not write anything else on this page.

WAIT UNTIL INSTRUCTED TO CONTINUE TO REMAINING QUESTIONS.

(Do not view any other pages.)

Do not write on this page.
(It is for use in grading only.)

Q	Full Score
1	1
2	2
3	2
4	2
5	3
6	5
7	5
8	5
9	15
10	10
total	50

2. (2 pts.) State the **two most significant differences** between literal and nonliteral tokens in *PLY*.
3. (2 pts.) Provide a Python/PLY code snippet that defines the literal tokens `+` and `*`.
4. (2 pts.) Provide a Python/PLY code snippet that defines the non-literal tokens `node` and `edge`.
5. (3 pts.) State what each of the two `L`s and the `1` signify in the type `LL(1)` for grammars.

6. (5 pts.) Prove or disprove (state which) this claimed equivalence between regular expressions in Python syntax:

$$(abc^*)^* \equiv (abc^*)^?$$

7. (5 pts.) Prove or disprove (state which) this claimed equivalence between regular expressions in Python syntax:

$$((a|b)c)^+ \equiv ((b|a)c)^*$$

8. (5 pts.) The following context-free grammar is presented using the textbook syntax. Express it using PLY syntax instead.

$$\begin{aligned} S &\rightarrow F H X \\ F &\rightarrow f \mid f F \\ H &\rightarrow h \mid o H e \\ X &\rightarrow s \mid s F s \end{aligned}$$

9. (15 pts.) For the grammar of Question 8, clearly state whether the following *sentence* is *valid* (belongs to the language of the grammar).¹ If it is valid then provide a *left-most derivation* for it *using classroom conventions* (in particular, underlining replaced symbols and annotating arrows with rule numbers); else explain (as precisely as possible) why it is not valid. Ignore all white space. [Hint: It may be easier to answer Question 10 first.]

f o o h e e s f f s

¹An earlier version had a typo (last s in the sentence was S) which was corrected at the exam.

[additional space for earlier material]

10. (10 pts.) If the sentence of of Question 9 is not valid then make as small a change as possible to yield a valid sentence (else use the unchanged sentence here). Provide a *parse tree* for the (original or modified) sentence.