

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	
<b>total</b>	<b>50</b>	

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 Ls 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.

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

9. (15 pts.) For the grammar of Question 8, clearly state whether the following *sentence* is *valid* (belongs to the language of the grammar).<sup>1</sup> 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

---

<sup>1</sup>An 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.