Compilers [Spring 2024]
Test II

NAME: _____

Instructions:

1) This test is 7 pages in length.

2) You have 75 minutes to complete and turn in this test.

3) Short-answer and essay questions will be graded on how clearly you've communicated the necessary ideas. Respond in complete English sentences. Avoid using bullet points and enumerated lists. Respond at the level of detail discussed in class.

4) This test is closed books, notes, papers, friends, neighbors, laptops, phones, smartwatches, etc.

1. [3 points] [1 sentence] What is djc's IR?

2. [4 points] [1-2 sentences] Besides the stack, what are the standard segments of program memory? Provide all the names discussed in class.

3. [6 points] [Short essay] How are types encoded in djc? Hit all the main points discussed in class.

4. [9 points] [Short essay] Compare and contrast internal and external compiler errors, as discussed in class. As part of your essay, identify which phases can have which sorts of errors.

5. [3 points] [1 sentence] In which part of the dj.y file are ASTs built?

6. [15 points] [Essay] Describe the djc AST data structure. For each member of the djc
AST node structure, explain its purpose.

7. [10 points] (a) Are regular languages closed under subset? Explain.
(b) Are context-free languages closed under subset? Explain.

8. [10 points] Define an algorithm to decide whether two input REs are equivalent.

9. [10 points] Define a CFG such that its LR(0), SLR, LALR, and LR(1) tables are identical and conflict free, and prove it.

10. [10 points] Define a CFG such that its LR(0), SLR, LALR, and LR(1) tables are identical and contain a conflict, and prove it.

11. [20 points] Show an LL(1) table for the following grammar G.

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0   S::=Y$
1   Y::=YY
2   Y::=bYd
3   Y::=ε
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Notice that G is not in LL(1), so define a G' equivalent to G and show that G' is in LL(1).

Undergraduates stop here. The remaining problem is for graduate students.

12. [10 points] Show an LALR table for a valid G' as defined in the previous problem.