CSE-304 Compiler Design

Fall '97

Mid-term Exam

Oct 28, 1997.

Duration: 1 hours, 15 minutes.

INSTRUCTIONS

Read the following carefully before answering any question.

- The exam for graduate students is different from the exam for the undergraduate students. Make sure you are reading the correct question paper.
- Doubts about the questions will be answered only in the first 15 minutes of the exam. So, read the questions carefully at the beginning of the exam.
- Keep your answers brief and precise.
- Answer each question on a separate sheet of paper. Write your name **and** your id number on the first sheet. Write your id number on the top right hand corner of each additional sheet.
- The exam consists of 2 pages and 6 questions, for a total of 100 points.

GOOD LUCK!

1. [**Total: 5 points**] Of the different phases of language translation, list all phases that are common between compilers and interpreters.

2. [**Total: 10 points**] Let L_2 be the set of all bit strings (*i.e,* strings over alphabet $\Sigma = \{0, 1\}$) that are divisible by 4.

   a. [5 points] Give a regular expression that describes L_2.

   b. [5 points] Give an NFA that recognizes strings in L_2.

3. [**Total: 20 points**] We want to write a filter **Capitalize** that copies a text file from **stdin** to **stdout**, replacing every lowercase letter at the beginning of a sentence to the corresponding uppercase letter. Write (**f**)**lex** specifications to implement **Capitalize**. DO NOT WRITE A C PROGRAM!

   Assume that every sentence ends with a period ("**.**") and sentences may be seperated by one or more white spaces (blanks, tabs or newlines). Also assume that there is a library function "**char ucase(char)**" that translates lowercase characters to uppercase (and returns the other characters unchanged). You need not translate the first sentence in the file.

4. [**Total: 20 points**] Consider the following grammar G_4:

$$S \longrightarrow a\,a\,S\,a\,b$$
$$S \longrightarrow a\,b\,S\,a\,a$$
$$S \longrightarrow \epsilon$$

   a. [5 points] Compute FIRST of S.

   b. [5 points] Compute FOLLOW of S.

   c. [10 points] Is G_4 an LL(1) grammar? Justify.

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5. **[Total: 15 points]** Consider the following grammar G_5':

$$S \longrightarrow \text{if Expr then } S \text{ else } S$$
$$S \longrightarrow \text{if Expr then } S$$
$$S \longrightarrow \text{other}$$

   a. **[10 points]** Is G_5 SLR(1)? Justify.

   b. **[5 points]** Can one build a recursive descent parser for G_5? Justify.

6. **[Total: 30 points]** Consider the following grammar G_6:

$$E \longrightarrow E + E$$
$$E \longrightarrow E * E$$
$$E \longrightarrow id$$

   a. **[10 points]** Compute the collection of LR(0) sets of items for G_6.

   b. **[10 points]** Construct the SLR(1) action table for G_6.

   c. **[10 points]** Is G_6 SLR(1)? If not, how can you modify G_6 to get a grammar SLR(1) grammar G_6' such that G_6 and G_6' represent the same language?

END OF EXAM