

ICS 142: Compilers and Interpreters

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Make Up Quiz

Instructions:

1. **Do not start until you are told to begin.**
2. Duration of the exam: **45 minutes.**
3. All questions have equal weight, but some are more difficult than others.
4. Your exam should have 2 questions. Please check to see if they are all there.
5. Place all class materials (books, notes, etc.) under your desk. This is a **closed book exam.**
6. Sign your name and ID # on the attendance sheet when it comes to you.
7. You may use the reverse sides of sheets if you need more room.
8. Mark your test in **permanent ink** if you want to be able to claim grading errors later.

Student ID Number _____

Name (print): _____

Name (sign): _____

Question 1: (50%)

Consider the following examples of “matchbox arithmetic”:

```
i + i = ii
iiii + ii = iiiiii
iii + i = iiii
```

A grammar that produces exactly all such sentences that represent legal addition of two numbers is the following (S is the start symbol):

```
S -> “i” A “i” .
A -> “i” A “i” | “+” “i” B “i” .
B -> “i” B “i” | “=” .
```

Write a short parser using the recursive-descent method for recognizing the sentences of this language. It is not important that your program is syntactically correct, but try to use either C# or Java for your answer.

You may assume that an object “fr” of class “FileReader” already exists and that the corresponding file reader has already been initialized and opened to the correct input file. The instance variable “fr.sym” holds the next character on the input, a pre-existing method “fr.next()” advances the input to the next character, and “fr.error()” signals an error. If fr.sym is equal to the constant FileReader.EOF, then the end of the input has been reached.

Question 2: (50%)

Given the grammar G with start symbol S (in which the empty string is denoted by “ ϵ ”):

$$S \rightarrow "1" S \mid "2" S S \mid "3" S S S \mid "x".$$

and the following table for a top-down parser:

	1	2	3	x	\$
S	1 S	2 S S	3 S S S	x	

show how the sentence:

1 2 x 1 1 x

is derived, by walking through the parsing process step by step. In separate columns, show (a) the contents of the stack, (b) the remaining characters on the input, (c) the production being applied (or “pop”), and (d) the derivation so far.

Stack	Input	Production	Derivation