

Fall, 2001

Prof. R. Fateman

CS 164 Midterm 1: September 26, 2001, 9:00AM

Read all instructions carefully.

There are 7 questions in the exam on 4 pages. Some questions have multiple parts.

You have 50 minutes to complete this test. The exam is closed book but you may refer to your one page (2-sides) handwritten 8.5 by 11 inch paper.

Please write your answers in the space provided. You may use the backs of the exam pages for scratch space. Solutions will be graded on correctness. Partial credit will be given.

Question	Grade	Out of
1		20
2		5
3		6
4		5
5		10
6		12
7		2
Total		60

State	Transitions		Final state?
	0	1	
S	S, T	S	
T	T		yes

1. [20 points] Here is a table describing an automaton with 2 states. The start state is S.
- Draw a diagram of the automaton in the space to the right of the table.
 - Write down a simple regular expression that describes the same language that is recognized by this automaton.
 - In the space below, draw a DFA that accepts the same language. Use as few states as possible.
 - Write a context free grammar G_0 that describes the same language.
2. [5 points] Write down a precise definition of $L(G)$ the language generated by any context free grammar G .
3. [6 points] Suppose grammar G_1 has only one rule rewriting X , namely $X \xrightarrow{*} YZW$.
- If we know that $a \in \text{First}(Y)$, what can you conclude about $\text{First}(X)$?
 - Under what condition is $\text{First}(W) \subseteq \text{First}(X)$?
 - Under what condition is $\epsilon \in \text{First}(X)$?
4. [5 points] Here are the rules for a grammar G_2 with start symbol S

$$\begin{aligned} S &\xrightarrow{*} aS \\ S &\xrightarrow{*} b \end{aligned}$$

Complete writing a recursive descent parsing program *parse* that returns yes, given a lisp list that constitutes a sentence in L(G2). We give you two useful parts already.

```
(defun parse (tokens)(s)(if (empty tokens) "yes"))

(defun eat(h) (cond((equal h (car tokens))(pop tokens))
(t (error "stuck at ~s" tokens))))
;; sample test: (parse '(a a b))
```

5. [10 points] What is the result of running your Tiger lexical analysis program *fsl* on a file containing this material:

```
if then loop else23 >>>= 45
"hello /* world" iconst */
```

6. [12 points] On the next page is an LL(1) Parsing Table for a grammar G3 with start symbol E.

a. What are the rules of the grammar G3?

b. What are the terminal symbols of G3?

	i	m	p	o	c	\$
E	TX			TX		
X			pE		ϵ	ϵ
T	iY			oEc		
Y		mT	ϵ		ϵ	ϵ

c. Trace each stack configuration in the parsing of the input string to $i c \$$. We have given you the first stack contents:

step	stack	input
1.	E \$	o i c \$

7. [2 points]

a. Describe any unusual piece of clothing worn on Monday Sept.24, by Prof. Fateman for the first 8 minutes of CS164 lecture.

b. How many CS164 lectures were delivered without the use of the video projector?