

**CS 164: Fall 1999
Midterm Solutions
Professor L. Rowe**

PROBLEM 1.

Answer the following TRUE/FALSE questions:

All non-deterministic finite state automata can be converted to a deterministic finite state automaton: TRUE

An object-oriented program is easier to read and understand than a conventional procedural program: TRUE

The class of the value assigned to the *this* variable in a method is the class within which the method is declared: FALSE

A Java method signature does not include the return type: TRUE

A *transient* instance variable in Java is not written to persistent storage if the object is output: TRUE

The class of the *Class* object is *Class*: TRUE

A regular expression can specify the set $a^n b^n$ where $0 \leq n < 5$, that is $\{ab, aabb, \dots, aaaabbbb\}$: TRUE

A shift reduce parser performs reductions in the reverse order specified by a left-most derivation: FALSE

The string *aabb* is a sentential form for the grammar $S \rightarrow ab \mid aSb$: TRUE

A JO99 variable has an l-value and r-value: TRUE

An abstract syntax tree is derived from a parse tree by removing extraneous nodes and restructuring the tree: TRUE

A handle is a simple phrase: TRUE

Some JO99 objects do not have a class: FALSE

The following finite state automation recognizes the language specified by the regular expression a^*1a^+ : FALSE

State Input NextState

```

0      1      1
0      a      0
1      a      2
2      1      1
2      a      2

```

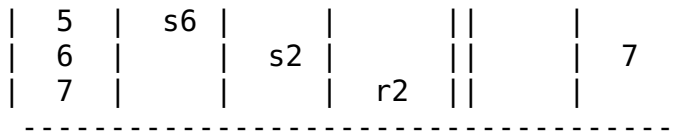
Starting state is 0

A context free grammar can be used to recognize any context sensitive language: FALSE

PROBLEM 2.

Given the parse table and grammar:

	b	a	\$	S	A
0	s3	s2		1	5
1			accept		
2	r4	s2	r4		4
3			r1		
4	r3		r3		



- r1: S->b
- r2: S->AbA
- r3: A->aA
- r4: A->a

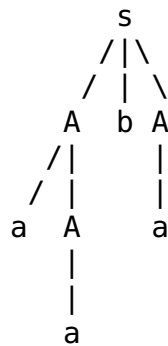
a) Show a right-most derivation for the input aaba.

S->AbA->Aba->aAba->aaba

b) When parsing the input aaba, how many shifts will be performed?

4

c) Show the parse tree for aaba.



PROBLEM 3.

Given the grammar

S->AcD

A->ablaAb

D->dIDd

a) What is the language?

$a^n b^n c^m$

$n, m \geq 1$

b) Fill-in the following sets:

FIRST(s) = {a}

FIRST{A} = {a}

FIRST{D} = {d}

c) Fill-in the following sets:

FOLLOW(S) = {\$}

FOLLOW{A} = {c, b}

FOLLOW{D} = {d, \$}

d) Given the item set I:

S'-.S\$

S->.AcD

A->.ab

A->.aAb

which is CLOSURE ($\{S'-.S\}$) for the grammar above, how many edges will exit this state in the canonical LR (0) collection?

3 exit edges

e) Given the item set I in part d, what items are in GOTO (I, a)?

A->a.b

A->a.Ab

A->.ab

A->.aAb

PROBLEM 4.

Given the following transition table:

State	Input	NextState
0	S	1
0	a	3
0	b	2
3	a	3
3	A	4
3	b	2
3	S	5
4	a	3
4	S	7
4	c	6

Starting state is 0

a) What are the dimensions in the ACTION table (i.e number of rows and number of columns)?

8 rows

4 columns (a, b, c, \$)

b) How many shift entries?

7

c) List the column headers in the GOTO table.

S, A

d) What entries might appear in ACTION table rows for states with no exiting edges?

reduce

accept

error (i.e. blank)

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