

Computer Science 164 - Spring 98

Midterm Examination

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Problem #1

(30 points) Define the following terms:

- parser
- terminal symbol
- abstract class
- method
- abstract syntax tree
- pushdown automaton
- grammar rule
- automatic parser generator
- handle
- instance
- arbitrary rewrite system
- syntax directed translation
- rvalue
- leftmost derivation
- reduce/reduce error

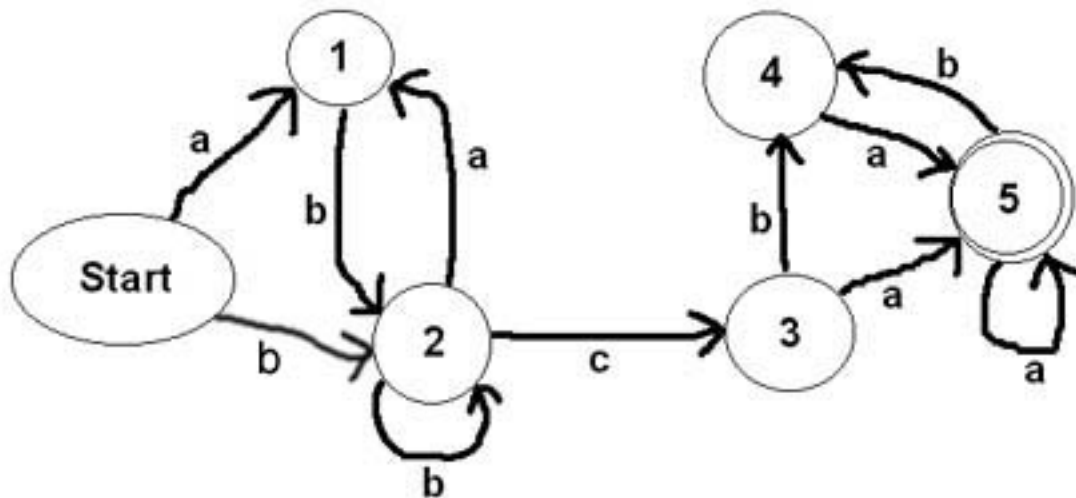
Problem #2

(10 points) Answer the following:

- T F** A pushdown automaton can recognize a language defined by a regular grammar.
- T F** A bottom-up parser performs reductions in the same order as a rightmost derivation.
- T F** A variable declared in Java to be a type `Class` can reference the object `Object`.
- T F** Class variables cannot be defined in a Java `abstract` class.
- T F** A nondeterministic fsa can recognize languages that a deterministic fsa cannot recognize.

Problem #3

(20 points) Answer the following questions given the fsa:



a) Identify which sentences are recognized by this automaton.

Yes	No	aab
Yes	No	bbabca
Yes	No	bcaabaaabaa
Yes	No	bbcb
Yes	No	abbbbabbabca

b) Show a left regular grammar that specifies the language recognized by the fsa. (Hint: write a grammar rule which would produce the fsa using the algorithm given in class.)

c) Describe in English the language recognized by the fsa.

Problem #4

(20 points) Given the following LR parser tables and grammar rules, answer the following questions.

	a	()	\$	S	L
0	s2	s3	.	.	1	.
1	.	.	.	acc	.	.
2	r1	r1	r1	r1	.	.
3	s2	s3	.	.	5	4
4	s2	s3	s6	.	7	.
5	r3	r3	r3	r3	.	.
6	r2	r2	r2	r2	.	.
7	r4	r4	r4	r4	.	.

The grammar is

- 1: $S \rightarrow a$
- 2: $S \rightarrow '(L)'$
- 3: $L \rightarrow S$
- 4: $L \rightarrow LS$

a) Show the parse tree for the sentence " $((a (a)))$ ".

b) Show the parser configurations as it parses that input in the following table. You must use state numbers on the syntax stack. (Hint: 22 configurations are shown in the table -- the parse may take less than, more than, or equal to that number of steps.)

step	stack	input	action
1	0	$((a (a))) \$$	shift 3
2	0 3	$(a (a)) \$$	shift 3
3			
4			
5			
6			

7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			

Problem #5

(20 points) Given the Java program fragments:

C.java:

```
package p;
public class C {
    public int x;
    protected double y;
    private char z;
    public char getZ( ) { return z; }
}
```

D.java:

```
package p;
public class D extends C {
    String S;
    public void f( ) {
        S = ((Integer)x).toString( );
    }
}
```

Hello.java:

```
package p;
public class Hello {
    public static void main(String[] args) {
        C ac = new C();
        D ad = new D();
    }
}
```

- Which instance variables can be accessed using the object `ac` in the method `main`?
- Which instance variables can be accessed using the object `ad` in the method `main`?
- Which instance variables can be accessed in the method called by `D.f()` in the method `main`?

Total: 100 points

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