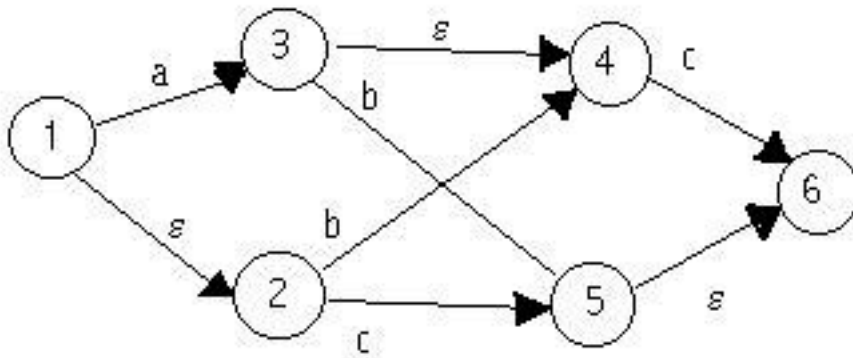


**CS164 Midterm #2**  
**Spring 1994**  
**Prof. L. Rowe**

1. (30 points; 2 points each) Circle T or F to indicate whether each statement is true or false.

- T    F A sentential form may only contain terminal symbols
- T    F The following grammar is a regular grammar:  
 $S \rightarrow A b \mid b$   
 $A \rightarrow a \mid S A$
- T    F The language specified by the grammar in the previous question is  
 $\{ b (ab)^* \} \cup \{ (ab)^+ \}$
- T    F There is no grammar and input sentence for which the leftmost and rightmost derivations are identical.
- T    F The following *flex* pattern will match at least the input: 123.45  
 $[^A-Za-z]^+.[^A-Za-z]$
- T    F A DFA may have less states than the number symbols in the input alphabet.
- T    F A bottom-up parser can generate better error messages than a top-down parser.
- T    F In *panic mode* error-recovery, the parser exits on the first error it encounters.
- T    F The address of a variable can never be an rvalue.
- T    F The language  $\{ a^n b^n c^n \}$  can be specified by a context free grammar.
- T    F The following automaton will recognize sentences in the language  
 $\{ a^* (b \mid c) d^* \}$



- T F The following is a leftmost derivation  
 $S \Rightarrow ABaD \Rightarrow aBbaD \Rightarrow abbaD \Rightarrow abbaC$
- T F In OO94, the compiler can determine what method to call at compile-time.
- T F A relocatable object file contains a symbol table that has an entry for each function not defined in the file that is called from a function defined in the file.
- T F A program that is to be run using shared text segments must be re-entrant.

## 2. (5 possible) Given the following code

```

class Person: Object { string name; int ssan, year_of_birth; };
class Student : Person { int units_completed, year_entered; };
Person myperson;
Student mystudent;
main () {
    myperson = Person.new();
    my student = Student.new();
};

```

Which of the following expressions when executed after the assignment statements in main will return a pointer to an object of type Cobject?

- (a) myperson.classof

(b) Cobject

(c) mystudent.classof.parent

(d) Object.classof

(e) none of (a)-(d)

(f) all of (a)-(d)

**3. (10 possible) Using the same class definitions as above, what is the type returned by the following expressions?**

(a) mystudent.classof.parent.new()

(b) Object.classof.new()

**4. (20 possible) The following table traces the contents of the stack of a shift-reduce parser. Upper case letters are non-terminals and lower case letters are terminals.**

Bottom

Top

```

a
a b
a X
a Y
a Y a
a Y a b
a Y a X
a Y a Y
a Y a Y c
a Y X
a Y
a Y c
X

```

(a) What is the input sentence?

(b) What is the grammar?

**5. (20 possible) Consider the following action/goto table for a shift-reduce parser.**

state	a	b	\$	S	A
0	s4	s6		1	2
1			accept		
2	s4	s6			3
3			r1		
4	s4	s6			5
5	r2	r2	r2		
6	r3	r3	r3		

and the rules:

r1:  $S \rightarrow A A$

r2:  $A \rightarrow a A$

r3:  $A \rightarrow b$

(a) What sequence of actions (e.g., shift to state  $i$ , reduce by rule  $j$ , accept or error) occur when parsing the input:  $b b a a$ ? The first action is given to you.

s6

(b) What is the minimum number of actions that this parser would have to go through when recognizing a valid sentence?

(c) What does it mean if the goto table does not contain a state number when the parser attempts to push a state on the stack after removing the handle during a reduce action?

**6. Show an unambiguous grammar for expressions with identifiers ( $id$ ) and the operators  $@$  and  $?$  where  $@$  is right associative,  $?$  is left associative, and  $@$  is lower precedence than  $?$ .**

For example, your grammar should be able to parse the sentence:

$id @ id ? id$

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