

On my honor, I have not given, nor received, nor witnessed any unauthorized assistance on this work.

Print name and sign: _____

Question:	1	2	3	Total
Points:	10	12	8	30
Score:				

1. (10 points) Construct a transition diagram for a lexical analyzer that recognizes the following patterns (left hand column) and associated tokens (right hand column):

Pattern	Token Name
(OPEN
)	CLOSE
)(ORDER
()	PAIR
((2OPEN
((((3OPEN

Label each arc with the symbol that triggers its transition and each accepting state with the token name (from the right hand column) it recognizes. Note the places where a character must be pushed back on the input stream.

2. Consider the following grammar:

```
E -> T E'
E' -> + T E' | ε
T -> F T'
T' -> * F T' | ε
F -> (E) | digit
digit -> 0 | 1 | 2 | ... | 9
```

(a) (9 points) Construct a parse tree for the sentence $9 + (0 * 1)$.

- (b) (3 points) Give 3 other strings which are defined by this grammar and have a different form than part a (in other words, not of the form $x + (y * z)$). You do not need to draw parse trees for them.

3. Consider the following context-free grammar:

$S \rightarrow S \text{ and } S \mid S \text{ or } S \mid (S) \mid \text{true} \mid \text{false}$

- (a) (2 points) List the **terminal(s)**: _____.
- (b) (2 points) List the **non-terminal(s)**: _____.
- (c) (4 points) A grammar can be ambiguous or unambiguous. The above grammar is ambiguous. Provide an example (and associated parse trees) which prove this fact.