PROBLEM 1.
Answer the following TRUE/FALSE questions:
All non-deterministic finite state automatons 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^b^n where 0&lt;n&lt;5, that is \{ab, aabb, ..., aaaaaabbbb\}: 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->ab | 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:

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>a</th>
<th>$</th>
<th>S</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>s3</td>
<td>s2</td>
<td></td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>accept</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>r4</td>
<td>s2</td>
<td>r4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>s2</td>
<td></td>
<td>r1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>r3</td>
<td></td>
<td>r3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

```
  s
   /\  \\
  /   \\
 /     \
A   b A
   /\   \\
  /   \\
 a A a
    |
     a
```

PROBLEM 3.
Given the grammar
S->AcD
A->ab|aAb
D->d|Dd

a) What is the language?

anbncdm
n, m &gt;=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:

\[
\begin{align*}
S' & \rightarrow .S$ \\
S & \rightarrow .AcD \\
A & \rightarrow .ab \\
A & \rightarrow .aAb
\end{align*}
\]

which is CLOSURE \(\{S' \rightarrow .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)?

\[
\begin{align*}
A & \rightarrow a.b \\
A & \rightarrow a.Ab \\
A & \rightarrow .ab \\
A & \rightarrow .aAb
\end{align*}
\]

PROBLEM 4.

Given the following transition table:

<table>
<thead>
<tr>
<th>State</th>
<th>Input</th>
<th>NextState</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>S</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>a</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>b</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>a</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>b</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>S</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>a</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>S</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>c</td>
<td>6</td>
</tr>
</tbody>
</table>

Starting state is 0

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