ASSIGNMENT #1 SOLUTION

Fill in the Blank.

1. Name: _____ **(1 point)**
2. I have satisfied the prerequisites of CS 303 Algorithms and Data Structures and CS 350 Formal Languages and Automata, or equivalent, each with a grade of C or better.

   Signature: _____ **(2 points)**

True or False.

For each of the problems below, indicate whether it is true or false. Justify your answer in either case. **(3 points each)**

3. A context-free grammar defining a deterministic context-free language may always be converted into a deterministic pushdown automaton.

   False. The algorithm which converts a CFG into a PDA will always produce a nondeterministic PDA.

4. The context-free grammar below is ambiguous.

   S → **if (e)** S | **if (e)** S **else** S | s

   True. The following are two distinct left-most derivations of the same string.

   S ⇒ **if (e)** S ⇒ **if (e) if (e)** S **else** S ⇒ **if (e) if (e)** s **else** S ⇒ **if (e) if (e)** s **else** s

   S ⇒ **if (e)** S **else** S ⇒ **if (e) if (e)** S **else** S ⇒ **if (e) if (e)** s **else** S ⇒ **if (e) if (e)** s **else** s

5. It is not possible to implement a tree data structure where interior nodes have an arbitrary number of children (e.g. some nodes may have 1 child, some 2, some 3, etc.).

   False. The children may be represented by a list.

Short Answer.

6. Assume a binary tree object with functions `value`, `left` and `right` to return the value of the current node, left subtree, and right subtree, respectively. Using an actual programming language or pseudo-code, write a function `postorder` to print the values of all nodes in the tree using a post-order traversal. Please write your answer on back. **(3 points)**

```
void postorder () {
  if (left () != null) left () . postorder ();
  if (right () != null) right () . postorder ();
  System . out . print (value ());
}
```