CS 480 Midterm 1

1. Explain why a lexical analyzer needs either a look-ahead system or a push back buffer. Give an example to illustrate your answer.

2. What are characteristics common to all types of translators?

3. Here are 3 grammars for 3 similar languages. One is ambiguous, one is LL(1) and one is LR(1). Identify each. Demonstrate why the one is ambiguous. Explain what property characterizes the LL(1) grammar. For the LR grammar draw the DFA that would be created by the parser.
   (a) \[ A ::= - A | B + A | 4 \]
   \[ B ::= \text{id} \]
   (b) \[ A ::= - A | A + B | 4 \]
   \[ B ::= \text{id} \]
   (c) \[ A ::= - B | 4 \]
   \[ B ::= B + \text{id} | \text{id} \]

4. Write the recursive descent recognizer procedures for the following grammar. You can assume that keywords, identifiers and numbers are handled by your lexical analyzer. (Think of S as representing statement, E as expression, and R as reference).
   \[ S ::= \text{if} \ E \ S | \text{while} \ E \ S | R = E \]
   \[ E ::= R | R + E \]
   \[ R ::= \text{id} | \text{id} \cdot \text{id} \]

5. Describe the activation record layout at the point the procedure m is executed in the following. Show where each variable will be in the activation record, and the offset for each.

```java
class foo
    var a : int
    var b : int
end

function m (d : int, e : int)
    var f : foo
    var g : int
    begin
        f.a = d
    end

function main ()
    var k : int
    begin
        m (32, k)
    end
```