1. Given the following CUP grammar snippet (assuming all other Lexing and terminals are correct):

\[\text{Stmt} ::= \text{Des AssignOp Des T_SEMI} (: \text{System.out.println("0"); :})
\]

\[\text{Des} ::= \text{T_STAR} (: \text{System.out.println("1"); :}) \text{Des} (: \text{System.out.println("2"); :})
\]

\[| \text{T_PLUSPLUS} (: \text{System.out.println("3"); :}) \text{Des} (: \text{System.out.println("4"); :})
\]

\[| \text{T_AMPERSAND} (: \text{System.out.println("5"); :}) \text{Des} (: \text{System.out.println("6"); :})
\]

\[| \text{Des2} (: \text{System.out.println("7"); :})
\]

\[\text{Des2} ::= \text{Des2} (: \text{System.out.println("8"); :}) \text{T_PLUSPLUS} (: \text{System.out.println("9"); :})
\]

\[| \text{Des3} (: \text{System.out.println("10"); :})
\]

\[\text{Des3} ::= \text{T_ID} (: \text{System.out.println("11"); :})
\]

\[\text{AssignOp} ::= \text{T_ASSIGN} (: \text{System.out.println("12"); :})
\]

What is the output when parsing the follow statement (you should have 10 lines/numbers in your output):

\[x = \text{ptr++};\]

What is the operator associativity of the operators in the Des production? (Lt-to-Rt or Rt-to-Lt)

_________________________________________
2. In Ken Thompson's Turing Award Lecture paper I handed out in class, he described

shipping the C compiler binary with code to detect if it was compiling the login program, and if so generate code in the login binary with a Trojan Horse (True or False) __________

shipping the C compiler binary with code to detect if it was compiling the C compiler, and if so generate code in the compiler to detect if it was compiling the C compiler (True or False) __________

shipping the C compiler binary with code to detect if it was compiling the C compiler, and if so generate code in the compiler to detect if it was compiling the login program (True or False) __________

shipping source code to the login program that had no trace of Trojan Horse code in it (True or False) ______

shipping source code to the C compiler that had no trace of Trojan Horse code in it (True or False) ______

3. Given the following variable declarations, determine if each line of code will cause
   A) No Error
   B) Syntax Error
   C) Semantic Error

   ```
   int a;
   bool b;
   float c;
   a = a + b; ______
   c = a c; ______
   a = a + a ______
   b = a + c; ______
   b = a < c; ______
   ```

4. Fill in the blanks with one of the following
   A) Front End
   B) Back End
   C) Intermediate Representation (IR)

   The parser is considered part of ______.
   The code generator is considered part of ______.
   The lexical analyzer is considered part of ______.
   The semantic analyzer is considered part of ______.
   A complete AST is considered part of ______.
   Machine independent code improvements are usually performed in ______.
   Machine dependent code improvements are usually performed in ______.

5. Describe two common ways a program can contain a dangling pointer/reference error:

1) ________________________________

2) ________________________________