This exam has 2 questions, for a total of 10 points.

1. **5 points** Given the following token definitions and grammar:

```plaintext
PRINT = "print"
NAME = "[a-zA-Z_][a-zA-Z0-9_]"
PLUS = "+
SUB = "-
EQ = "=
INT = "[0-9]"

module ::= statement
statement ::= PRINT expression | NAME EQ expression | expression
statement_list ::= statement | statement statement_list
expression ::= NAME | INT | SUB expression | expression PLUS expression
```

show the tokenization and parse tree for the following program. The precedence and associativity of the arithmetic expressions is the same as in Python.

```plaintext
x = 2
print - x+1
```

**Solution:**

```
x = 2
print - x + 1
```
2. [5 points] Given the following token definitions and grammar but no specified precedence or associativity

\[
\begin{align*}
\text{IF} & = "if" \\
\text{THEN} & = "then" \\
\text{INT} & = \"[0-9]+\" \\
\text{PRINT} & = "print" \\
\text{expr} & ::= \text{INT} \\
\text{stmt} & ::= \text{IF expr THEN stmt} \\
& \quad | \text{IF expr THEN stmt ELSE stmt} \\
& \quad | \text{PRINT expr}
\end{align*}
\]

draw all of the parse trees for the following program.

\[
\text{if 0 then if 1 then print 2 else print 3}
\]