6.1100 Spring 2024 Miniquiz #1

There are 2 pages. Please submit your answers on Gradescope by Feb 15th, 2024, 11:59pm.

Name:

Email:

1. Regular languages

a. Let Σ = {`0`, `1`, `.`}. Give a regular expression that accepts all strings containing the substring `11`. The string may have at most one decimal point. The string should not have any redundant leading zeros. For example, 1.1100, 0.00110, 10110, and 10.011 are all valid binary strings, while 011, 0.110.0, 100 are not.

b. Construct an NFA or a DFA that recognizes the language in part a.

2. Context-free languages

Given the following context-free grammar:

```
BoolExpr → BoolExpr and BoolExpr    (1)
BoolExpr → BoolExpr or BoolExpr     (2)
BoolExpr → ( BoolExpr )             (3)
BoolExpr → true                     (4)
BoolExpr → false                    (5)
```

where *BoolExpr* is the only non-terminal in the grammar. These tokens are terminal: `and`, `or`, `(`, `)`, `true`, `false`.

a. The following string can be parsed as a *BoolExpr*:

   `(true or false and true).`

   However, there are more than one possible leftmost derivations, thus the grammar is ambiguous. Illustrate the problem by drawing two different parse trees for this string.

b. Design an *unambiguous* context-free grammar that recognizes the same set of strings and respects operator precedence, i.e. `and` should bind more tightly than `or`.