

# CMSC 330 Quiz 4 Spring 2022

## Q1. Loco Lists

Q1.1. Write a CFG to represent a list consisting of positive integers and other lists. These lists (and sublists) can have arbitrarily large dimensions.

### Notes:

- An empty list is also a valid list.
- You can use  $n$  to denote a positive integer in the CFG. You don't have to worry about representing multidigit numbers since  $n$  encapsulates them all.
- To represent  $\epsilon$  in the CFG, you can either write the word epsilon or just type the letter  $e$ .

### Examples of Valid Lists:

```
[]  
[[[]]]  
[1, [[1, 2], [4], 56], [[[564]]]]  
[1, 2, 3]
```

Q1.2. Is the language defined by the grammar given above regular?

Yes/No

## Q2. Context-Free Grammars

My friend Hamza with a peculiar lexicon likes modifying common acronyms in his speech and texting as defined by the following CFG:

```
S -> A | B  
A -> lol  
L -> l | l out loud | A  
B -> smH  
H -> h | h my head | B
```

Can the grammar above be parsed by a LL1 recursive descent parser (like Project 4)? Justify your answer.

## Q3. Ambiguity

Prove that the following grammar is ambiguous:

```
S -> bS | Sb | T  
T -> Sa | Sb | Sc |  $\epsilon$ 
```

## Q4. Operational Semantics

Using the gives rules, fill in the blanks the complete the derivation below:

$$\begin{array}{c}
 \frac{}{A; n \Rightarrow n} \quad \frac{A(x) = v}{A; x \Rightarrow v} \\
 \\
 \frac{A; e_1 \Rightarrow v_1 \quad A, x : v_1; e_2 \Rightarrow v_2}{A; \text{let } x = e_1 \text{ in } e_2 \Rightarrow v_2} \\
 \\
 \frac{A; e_1 \Rightarrow v_1 \quad A; e_2 \Rightarrow v_2 \quad v_3 \text{ is } v_1 \wedge v_2}{A; e_1 \wedge e_2 \Rightarrow v_3} \\
 \\
 \frac{\frac{\frac{A, x : \text{"cmsc"}, y : \text{"330"}; x \Rightarrow \text{"cmsc"} \quad A, x : \text{"cmsc"}, y : \text{"330"}; y \Rightarrow \text{"330"} \quad (\#6)}{A, x : \text{"cmsc"}, y : \text{"330"}; (\#3) \Rightarrow \text{"cmsc330"}} \quad (\#5)}{A, x : \text{"cmsc"}; \text{let } y = \text{"330"} \text{ in } x \wedge y \Rightarrow \text{"cmsc330"}} \quad (\#2)}{A; \text{"cmsc"} \Rightarrow \text{"cmsc"}} \quad (\#1) \text{ in let } y = \text{"330"} \text{ in } x \wedge y \Rightarrow \text{"cmsc330"}
 \end{array}$$

Blank #1:

Blank #2:

Blank #3:

Blank #4:

Blank #5:

Blank #6: