Quiz 3 from Fall 2021

STUDENT NAME

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Q1 Context-Free Grammars

8 Points

Q1.1

4 Points

Construct a CFG that matches the following regex:

```
a*m+n?
```

Enter your answer here

Save Answer

Q1.2

4 Points

Prove that the following CFG is ambiguous:

```
S -> S + T | T
T -> 1 + T | 1
```

Enter your answer here

Save Answer

Q2 Parsing

8 Points

Q2.1

3 Points

Rewrite the following context-free grammar so that it can be parsed through recursive descent without creating an infinite loop.

```
S -> S or S | S and S | B
B -> not B | V
V -> true | false
```

NOTE: The rewritten grammar should accept the same strings as the one provided above.

Enter your answer here

Save Answer

Q2.2

5 Points

Consider the following:

```
type token =
| Tok_Char of char
| Tok_Plus
| Tok_Comma

(* NOTE: This is an imperative implementation! *)

let lookahead () =
  match !tok_list with
  | [] -> raise (ParseError "no tokens")
  | (h::t) -> h

let match_tok a =
  match !tok_list with
  | (h::t) when a = h -> tok_list := t
  | _ -> raise (ParseError "bad match")
```

Complete the context-free grammar that is parsed by the code below.

```
let rec parse_S () =
  parse_T ();
  match lookahead () with
  | Tok_Plus -> (match_tok Tok_Plus; parse_S ())
  | Tok_Comma -> (match_tok Tok_Comma; parse_T (); match_tok Tok_Comma; parse_S ())
  | _ -> ()

and parse_T () =
  parse_A ();
  match lookahead () with
  | Tok_Char 'b' -> (match_tok (Tok_Char 'b'))
  | Tok_Char 'c' -> (match_tok (Tok_Char 'c'))
  | _ -> ()

and parse_A () =
  match lookahead () with
```

```
    | Tok_Char 'a' -> (match_tok (Tok_Char 'a'))
    | _ -> ()
```

Note: You can use E or e to denote an epsilon

S ->

Enter your answer here

T ->

Enter your answer here

A ->

Enter your answer here

Save Answer

Q3 Operational Semantics

4 Points

$$\frac{}{A; n \to n} \qquad \frac{A(x) = v}{A; x \to v} \qquad \frac{A; e_1 \to v_1 \qquad A, x : v_1; e_2 \to v_2}{A;\ \textbf{let}\ x = e_1\ \textbf{in}\ e_2 \to v_2}$$

$$\frac{A; e_1 \to v_1 \quad A;\ e_2 \to v_2 \quad v_3\ is\ v_1 + v_2}{A;\ e_1 + e_2 \to v_3}$$

$$\frac{A; e_1 \to n_1 \qquad A; e_2 \to n_2 \qquad n_1 > n_2}{A; e_1 > e_2 \to \textbf{true}} \qquad \frac{A; e_1 \to n_1 \qquad A; e_2 \to n_2 \qquad n_1 \leq n_2}{A; e_1 > e_2 \to \textbf{false}}$$

$$\frac{A; e_1 \to \textbf{true} \qquad A; e_2 \to v}{A;\ \textbf{if}\ e_1\ \textbf{then}\ e_2\ \textbf{else}\ e_3 \to v} \qquad \frac{A; e_1 \to \textbf{false} \qquad A; e_3 \to v}{A;\ \textbf{if}\ e_1\ \textbf{then}\ e_2\ \textbf{else}\ e_3 \to v}$$

Using the above rules, fill in the blank for the derivation below:

$$\dfrac{\dfrac{}{A;\ 5 \to 5} \qquad \dfrac{\dfrac{}{\boxed{2}} \qquad \dfrac{\dfrac{A,x\!:5,y\!:2;\ 1 \to 1 \quad A,x\!:5,y\!:2;\ 0 \to 0 \quad 1 > 0}{A,x\!:5,y\!:2;\ \boxed{3}} \qquad \dfrac{\boxed{4}}{A,x\!:5,y\!:2;\ y \to 2}}{A,x\!:5,y\!:2; if\ 1 > 0\ then\ y\ else\ x\ \to\ 2}}{A,x\!:5;\ let\ y = 2\ in\ if\ 1 > 0\ then\ y\ else\ x\ \to\ 2}}{A;\ \boxed{1}\ let\ y = 2\ in\ if\ 1 > 0\ then\ y\ else\ x\ \to\ 2}$$

IMPORTANT: Double-check that the BLUE box numberings correspond with your answers; the boxes are numbered from bottom to top. We will not accept out-of-order answers.

Blank #1

Enter your answer here

Blank #2

Enter your answer here

Blank #3

Enter your answer here

Blank #4

Enter your answer here

Save Answer

Save All Answers

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