Quiz 4

STUDENT NAME

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Q1
6 Points

Consider the following Grammar:
$S \rightarrow S \wedge S | S \vee S | \sim S | T$
$T \rightarrow true | false | a | b | c$

Q1.1 Grammars
2 Points

Show each step of any valid derivation of
$false \vee true \wedge \sim false$

S -> S v S->T v S -> false v S -> false v S ^ S -> false v T ^ S -> false v true ^ S -> false v true^~S -> false v true ^ ~T -> false v true ^ ~false

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Q1.2
4 Points

Rewrite the grammar so that is not ambiguous and that the precedence is as follows: $\sim, \wedge, \vee$

S -> T v S | T
T -> A ^ T | A
A -> ~A | B
B -> true | false | a | b | c

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Q2 Parsing

8 Points

Assume you have the following tokens:

```
type tok = Int of int|Plus|Minus
```

Assume you have the following AST type:

```
type ast = Num of int
         |Add of ast * ast
         |Sub of ast * ast
```

Using the post fix notation our grammar is:
$S \Rightarrow NS+|NS-|N$
$N \Rightarrow n$, where n is a number

Using the grammar write a parser for `parse_S`. If any error occurs, `failwith "error"`

```
let lookahead lst = match lst with
  [] -> failwith "error"
  |h::t -> h

let match_tok lst tok = match lst with
  | h::t when h = tok -> t
  | _ -> failwith "error"

let parse_N toklst = match toklst with
  Int(x)::t -> (Num(x),t)
  |_ -> failwith "error"

and rec parse_S toklst =
```

let rec parse_S expr =
let (e,t) = parse_N expr in
match t with
[] -> (e,t)
|Plus::_ -> (e,t)
|Minus::_ -> (e,t)
|_ -> let (e1,t1) = parse_S t in (match t1 with
Plus::t -> (Add(e,e1),t)

```
|Minus::t -> (Sub(e,e1),t)
|_ -> failwith "error");;
```

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Q3 OpSem

6 Points

Consider the following OpSem Rules:

$$\frac{}{A;\ \text{true} \Rightarrow \text{true}} \qquad \frac{}{A;\ \text{false} \Rightarrow \text{false}}$$

$$\frac{A;\ \text{e}_1 \Rightarrow \text{true}}{A;\ (\text{not e}_1) \Rightarrow \text{false}} \qquad \frac{A;\ \text{e}_1 \Rightarrow \text{false}}{A;\ (\text{not e}_1) \Rightarrow \text{true}}$$

$$\frac{A;\ \text{e}_1 \Rightarrow \text{true} \qquad A;\ \text{e}_2 \Rightarrow \text{v}_1}{A;\ (\text{if e}_1\ \text{then e}_2\ \text{else e}_3) \Rightarrow \text{v}_1}$$

$$\frac{A;\ \text{e}_1 \Rightarrow \text{false} \qquad A;\ \text{e}_3 \Rightarrow \text{v}_1}{A;\ (\text{if e}_1\ \text{then e}_2\ \text{else e}_3) \Rightarrow \text{v}_1}$$

$$\frac{A;\ \text{e}_1 \Rightarrow \text{v}_1 \qquad A;\ \text{e}_2 \Rightarrow \text{v}_2 \qquad \text{v}_3\ \text{is}\ \text{v}_1\ ||\ \text{v}_2}{A;\ (\text{e}_1\ ||\ \text{e}_2) \Rightarrow \text{v}_3}$$

Fill in the following derivation:

$$\dfrac{\dfrac{\dfrac{}{A;\ \#3 \Rightarrow \#3} \qquad \dfrac{}{A;\ \#4 \Rightarrow \#4} \qquad \#5\ \text{is}\ \#1}{A;\ \#1 \Rightarrow \#5} \qquad \dfrac{}{A;\ \#2 \Rightarrow \#2}}{\text{if}\ true || false\ \text{then}\ true\ \text{else not}\ false \Rightarrow \#6}$$

Blank #1:

true || false

Blank #2:

true

Blank #3:

true

Blank #4:

false

Blank #5:

true

Blank #6:

true

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