

CMSC 330, Fall 2019 — Quiz 3

NAME _____

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INSTRUCTIONS

- Do not start this quiz until you are told to do so.
- You have 15 minutes for this quiz.
- This is a closed book quiz. No notes or other aids are allowed.
- For partial credit, show all your work and clearly indicate your answers.

1. [8 pts] Using the rules given below, show: $A; \text{let } x = 3 \text{ in } x + x \Rightarrow 6$

$$\begin{array}{c}
 \frac{}{A; n \Rightarrow n} \qquad \frac{A(x) = v}{A; x \Rightarrow v} \\
 \\
 \frac{A; e_1 \Rightarrow v_1 \quad A, x : v_1; e_2 \Rightarrow v_2}{A; \text{let } x = e_1 \text{ in } e_2 \Rightarrow v_2} \qquad \frac{A; e_1 \Rightarrow n_1 \quad A; e_2 \Rightarrow n_2 \quad n_3 \text{ is } n_1 + n_2}{A; e_1 + e_2 \Rightarrow n_3} \\
 \\
 \frac{}{A; 3 \Rightarrow 3} \qquad \frac{A, x : 3(x) = 3}{A, x : 3; x \Rightarrow 3} \qquad \frac{A, x : 3(x) = 3}{A, x : 3; x \Rightarrow 3} \qquad 6 \text{ is } 3 + 3 \\
 \hline
 \frac{}{A; 3 \Rightarrow 3} \qquad \frac{A, x : 3; x \Rightarrow 3 \quad A, x : 3; x \Rightarrow 3}{A, x : 3; x + x \Rightarrow 6} \\
 \hline
 A; \text{let } x = 3 \text{ in } x + x \Rightarrow 6
 \end{array}$$

2. [6 pts] Write a context-free grammar (CFG) that accepts the same language of strings described by:

$$a^n b^m c^{2n}$$

where $m, n \geq 0$

$$S \rightarrow \mathbf{a} S \mathbf{c} \mathbf{c} \mid T$$

$$T \rightarrow \mathbf{b} T \mid \epsilon$$

3. [6 pts] Given the following grammar, complete the parse functions. *lookahead* and *match_tok* are given.

$$S \rightarrow \mathbf{a} S \mathbf{b} \mid T \mathbf{b}$$

$$T \rightarrow \mathbf{c} T \mid \mathbf{c}$$

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

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

```
let rec parse_S () =  
  if (lookahead () = "a") then  
    match_tok "a";  
    parse_S ();  
    match_tok "b";  
  else  
    parse_T ();  
    match_tok "b";
```

```
and rec parse_T () =  
  match_tok "c";  
  if (lookahead () = "c") then  
    parse_T ();  
  else  
    ()
```