CMSC 330, Spring 2018 Quiz 2

Name _____

Discussion Time (circle one)   10am   11am   12pm   1pm   2pm   3pm

Discussion TA (circle one)   BT   Daniel   Chris   Alex   Derek   Pei-Jo   Akbar   Justin L.
Tal   Shriraj   Cameron   Eric   Kesha   Kameron   Michael S.   Michael P.

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. *(5 points)* Using the rules given below, show

$$1*2 + 3 \quad \Rightarrow \quad 5$$

In the rules, n is a metavariable that refers to an integer, while e is a metavariable that refers to an expression, whose form is according to the following grammar:

$$e \ ::= \ n \mid e\texttt{+}e \mid e\texttt{*}e$$

Here are the rules:

$$\frac{}{n \Rightarrow n} \qquad \frac{e_1 \Rightarrow n_1 \quad e_2 \Rightarrow n_2 \quad n_3 \ is \ n_1 + n_2}{e_1 + e_2 \Rightarrow n_3}$$

$$\frac{e_1 \Rightarrow n_1 \quad e_2 \Rightarrow n_2 \quad n_3 \ is \ n_1 * n_2}{e_1 * e_2 \Rightarrow n_3}$$

2. *(7 points)* Using the rules given below, show:

$$\texttt{let } y = 1 \texttt{ in let } x = 3 \texttt{ in } x \quad \Rightarrow \quad 3$$

In the rules, x is a metavariable that refers to an identifier (variable), n is a metavariable that refers to an integer, while e is a metavariable that refers to an expression, and A is a metavariable that refers to an environment. Grammars for the latter two are as follows:

$$\begin{aligned} e &::= x \mid n \mid \texttt{let } x = e \texttt{ in } e \\ A &::= \cdot \mid A, x{:}n \end{aligned}$$

In the above, $\cdot$ represents an empty environment, while $A, x : n$ is the environment that extends A with a mapping from x to n (overriding any other mapping that might already be in A for x).

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

3. *(8 points)* Give a Finite Automata that accepts a string on alphabet 0,1 if and only if it has an even number of 1's and exactly one zero.