CMSC330 Spring 2023 Quiz 4

Proctoring TA: N	lame:		
UID:			
Problem 1: Basics			[3 pts]
Please circle True or False for the following statements:			
All Regular Expressions can be expressed as CFGs		True	False
One could theoretically implement NFA to DFA in Lambda Calculus		True	False
Ambiguous Grammars grammars have at maximum, one right-most and o	one left-most deriviation for any given string	True	False
Problem 2: Operational Semantics			[6 pts]

Consider the following rules for a subset of OCaml

$$\overline{true \rightarrow true}$$
 $\overline{false \rightarrow false}$ $\underline{A; e_1 \Rightarrow v_1}$ $\underline{A; e_2 \Rightarrow v_2}$ v_1 is equal to v_2 $\underline{A; e_1 \Rightarrow v_1}$ $\underline{A; e_2 \Rightarrow v_2}$ v_1 is not v_2 $A; e_1 \Rightarrow v_1$ $A; e_2 \Rightarrow v_2$ v_1 is not v_2 $A; e_1 \Rightarrow v_1$ $A; e_2 \Rightarrow v_2$ v_1 is not v_2 $\underline{A, x: v (x) = v}$ $\underline{A, x: v; x \Rightarrow v}$ $\underline{A; e_1 \Rightarrow v_1}$ $\underline{A, x: v_1; e_2 \Rightarrow v_2}$ $A; e_1 \Rightarrow v_1$ $A; e_2 \Rightarrow v_2$ v_3 is the max of v_1 and v_2 $A; horder horder$

Consider the following Grammars:

		Grammar 1	Grammar	2 Gram	mar 3	Grammar 4
		S -> AB	S -> ASB	S -> 2	Sc AB	S -> ASB cSc c
		A -> aA a	A -> aA a	A ->	aA a	A -> aA a
		B -> bbB $ \epsilon$	B -> bbB e	8 B ->	bbB $ \epsilon $	B -> bbB bb
[1 pts]	(a) Which gramm	ar accepts both "aaal	ob" and "aaabbcc"			
			Grammar 1	Grammar 2	Grammar 3	3
[1 pts]	(b) Which Gramm	nar is ambiguous?				
			Grammar 1	Grammar 2	Grammar 3	3
[2 pts]	(c) Which strings	are accepted by Gran	nmar 4?			

aaacbbb aaacbbbb ccaaabbbbcc cacacbbbb

[7 pts] Problem 4: Lambda Calculus

[3 pts] (a) Circle the free variables and underline the bound variables in the following lambda calculus expression

$$(\lambda x.((\lambda y.(xy))xz))(\lambda z.w)$$

Consider the following λ expressions

$$(\lambda x.(\lambda y.xy))((\lambda y.a)(\lambda x.x))$$

[2 pts] (b) Which of the following is the result of reducing the outer-most expression **once** using lazy (call by name) evaluation?

$$(\lambda x.(\lambda y.xy))a$$
 $\lambda y.((\lambda y.a)(\lambda x.x))y$ $\lambda y.ay$

[2 pts] (c) Which of the following is the result of reducing the outer-most expression **once** using eager (call by value) evaluation?

$$(\lambda x.(\lambda y.xy))a$$
 $\lambda y.((\lambda y.a)(\lambda x.x))y$ $\lambda y.ay$