

CMSC 330 Spring 2017 Quiz #4

Name _____

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

Discussion TA (circle one) Aaron Alex Austin Ayman Daniel Eric
Greg Jake JT Sam Tal Tim Vitung

Instructions

- Do not start this quiz until you are told to do so.
- You have 20 minutes for this quiz.
- This is a closed book quiz. No notes or other aids are allowed.
- For partial credit, show all of your work and clearly indicate your answers.

1. (4 points) Circle ALL expressions that are equivalent to the following lambda expression

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

i. $(\lambda x.x z) (\lambda y.w) (\lambda w.w y x z)$

ii. $(\lambda x.(x z)) \lambda y.w \lambda w.w y x z$

iii. $(\lambda x.x z) \lambda y.(w (\lambda w.(w y x z)))$

iv. $(\lambda x.x z) \lambda y.w \lambda w.(w (y (x z)))$

2. (2 points) Are the following two terms alpha equivalent? (Circle One) YES NO

$$(\lambda x.x (\lambda y.x y) y) z$$

$$(\lambda x.x (\lambda a.x a) a) z$$

3. (4 points) Reduce the following lambda expression:

$$(\lambda a.\lambda c.c b a) c (\lambda d.\lambda e.e)$$

4. (5 points) Given the following language, provide a parse tree for “true and true or true”

$S \rightarrow S \text{ or } S \mid L$

$L \rightarrow \text{true and } L \mid \text{true}$

5. (5 points) Make the following grammar left associative with “()” having higher precedence than “and”. You can introduce new non-terminals if necessary.

$S \rightarrow (S) \mid S \text{ and } S \mid \text{true} \mid \text{false}$