CMSC 330, Spring 2018 Quiz 4

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. *(2 points)* Make all parentheses explicit in the following λ-expression:

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

2. *(4 points)* Which of the following are alpha equivalent to $(\lambda x.\ x\ (\lambda x.\ y\ x))\ y$

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

    B $(\lambda\ z.\ z\ (\lambda\ a.\ y\ a))\ y$

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

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

3. *(6 points)* If possible, completely reduce the following, otherwise write "Not Possible"

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

      Not Possible

    B $(\lambda\ a.\ b)\ x$

      b

4. *(8 points)* Reduce the following λ-expression as much as possible. To receive partial credit, make sure to show alpha conversions and beta reductions.

$$(\lambda \ a.b \ a \ b) \ (\lambda \ c. \ \lambda \ b. \ b \ c) \ c$$
$$b \ (\lambda \ x. \ \lambda \ y. \ y \ x) \ b \ c$$