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

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.
   \[ S \rightarrow (S) \mid S \text{ and } S \mid \text{true} \mid \text{false} \]