

CMSC330 Fall 2011 Example Quiz #4

Name _____

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

Do not start this exam until you are told to do so!

Instructions

- You have 25 minutes for this quiz.
- This is a closed book exam. No notes or other aids are allowed.
- Answer essay questions concisely using 2-3 sentences. Longer answers are not necessary and a penalty may be applied.
- For partial credit, show all of your work and clearly indicate your answers.
- Write neatly. Credit cannot be given for illegible answers.

1. (14 pts) Parsing

Consider the following grammar: $S \rightarrow aA \mid A$ $A \rightarrow bS \mid ca$

a. (6 pts) Compute First sets for S and A

b. (8 pts) Write a predictive, recursive descent parser for the grammar

2. (16 pts) Lambda calculus

Circle all free (unbound) variables in the following λ -expression

a. (2 pts) $(\lambda a. a (\lambda b. b a) a b) a$

Evaluate the following λ -expressions as much as possible. Show each beta-reduction

b. (3 pts) $(\lambda x. \lambda y. y x) a (\lambda z. z) b$

c. (3 pts) $(\lambda y. \lambda x x y) x a b$

d. (8 pts) Using encodings, show $3 * 1 \Rightarrow^* 3$. Show each beta-reduction.

\Rightarrow^* indicates 0 or more steps of beta-reduction

$3 * 1 \Rightarrow$

$\begin{aligned} M * N &= \lambda x. (M (N x)) \\ 1 &= \lambda f. \lambda y. f y \\ 2 &= \lambda f. \lambda y. f (f y) \\ 3 &= \lambda f. \lambda y. f (f (f y)) \\ 4 &= \lambda f. \lambda y. f (f (f (f y))) \end{aligned}$
