Q1 Multichoice Questions (1130 only)
10 Points

This document contains questions for COMP1130 students only to attempt.

There are four multiple choice questions in this document, worth 2.5 marks each, for a total of 10 marks. Incorrect or missing answers earn 0 marks, without further mark penalty. Each question is intended to have one best answer.

Q1.1 Lambda Calculus Syntax
2.5 Points

Consider the lambda-calculus term

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

The following lambda-calculus terms have had some parentheses removed and variables renamed. Which one is alpha-equivalant to the term above?

- $(\lambda u.\lambda v.yu)(\lambda w.uw)y$
- $(\lambda u.\lambda v.yu)(\lambda w.xw)y$
- $(\lambda u.\lambda v.yv)(\lambda w.vw)y$
- $(\lambda u.\lambda v.yv)(\lambda w.xw)y$
- $(\lambda u.\lambda v.yu(\lambda w.uw))y$
- $(\lambda u.\lambda v.yu(\lambda w.xw))y$
- $(\lambda u.\lambda v.yv(\lambda w.vw))y$
- $(\lambda u.\lambda v.yv(\lambda w.xw))y$

Save Answer

Q1.2 Beta-Reduction
2.5 Points

Consider the term

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

Which of the options below is a correct and complete beta-reduction of this term? Note that alpha-equivalences, if any, are not given explicitly.

- $\to (\lambda x.xx)(\lambda x.y) \to (\lambda x.x)(\lambda x.y) \to (\lambda x.y)$
- $\to (\lambda x.xx)(\lambda x.y) \to (\lambda x.y)(\lambda x.y) \to y$
- $\to (\lambda x.y)(\lambda y.y(\lambda x.y)) \to y$
- $\to (\lambda x.y)(\lambda z.z(\lambda x.y)) \to y$
- $\to (\lambda x.z)(\lambda y.y(\lambda x.z)) \to z$
- $\to (\lambda y.yx)(\lambda x.y) \to x(\lambda x.y)$
- $\to (\lambda y.yx)(\lambda x.y) \to (\lambda x.y)x \to y$

Save Answer

Q1.3 Encodings
2.5 Points

Assume we have some correct encoding of Booleans, and recall Barendregt's encoding of the natural numbers (presented here in a slightly different form from the slides):

$0 = \lambda x.x$
$n + 1 = \lambda x.\text{if } x \text{ then False else } n$

Which of the following is a correct definition of a term that returns True on input 1 and False on all other Barendregt natural numbers?

- $\lambda x.\text{if}(x\ \text{True})\text{then False else}(x\ \text{False True})$
- $\lambda x.\text{if}(x\ \text{True})\text{then False else}(x\ \text{True False})$
- $\lambda x.x\ \text{False True}$
- $\lambda x.x\ \text{True False}$

Save Answer

Q1.4 Case expressions
2.5 Points

Assume we have a fixed point combinator, for example Turing's Θ, as well as correct encodings for Booleans and natural numbers, including multiplication $\times$, and consider these terms:

A = $\Theta(\lambda f.\lambda x.\mathsf{if}(\mathsf{isZero}\,x)\mathsf{then}\,1\,\mathsf{else}(x \times (f(\mathsf{pred}\,x))))$
B = $\lambda f.\Theta(\lambda x.\mathsf{if}(\mathsf{isZero}\,x)\mathsf{then}\,1\,\mathsf{else}(x \times (f(\mathsf{pred}\,x))))$
C = $\lambda f.\lambda x.\Theta(\mathsf{if}(\mathsf{isZero}\,x)\mathsf{then}\,1\,\mathsf{else}(x \times (f(\mathsf{pred}\,x))))$

Which of those terms is a correct definition of a factorial function?

A only

B only

C only

A and B only

A and C only

B and C only

All three are correct

Save Answer

Save All Answers

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