COMP3161/9164 24T3 Assignment 0 Latex Snippets

September 23, 2024

1 Purpose

This document quotes the LAT_EX source of some of the assignment spec document, both as a guide and example, and so that you can use the same fonts and styles for math terms in your answers as used in the questions.

There will be no marks won or lost for purely aesthetic concerns such as using the same fonts as in the question.

Part A

The language of boolean expressions \mathcal{P} contains terms such as:

```
{True, False, \negTrue, \negFalse, True \land False, \neg(True \landFalse),...}
```

The *abstract syntax* of \mathcal{B} contains:

 $\mathcal{B} ::= \mathsf{Not} \ \mathcal{B} \mid \mathsf{And} \ \mathcal{B} \ \mathcal{B} \mid \mathsf{True} \mid \mathsf{False}$

The big-step semantics of $\mathcal B$ is defined by:

$$\frac{x \Downarrow \mathsf{True}}{\mathsf{Not} \ x \Downarrow \mathsf{False}}(\mathsf{N}_1) \quad \frac{x \Downarrow \mathsf{False}}{\mathsf{Not} \ x \Downarrow \mathsf{True}}(\mathsf{N}_2) \quad \frac{1}{\mathsf{True} \Downarrow \mathsf{True}}(\mathsf{N}_3) \quad \frac{1}{\mathsf{False} \Downarrow \mathsf{False}}(\mathsf{N}_4) \\ \frac{x \Downarrow \mathsf{False}}{\mathsf{And} \ x \ y \Downarrow \mathsf{False}}(\mathsf{N}_5) \quad \frac{x \Downarrow \mathsf{True} \quad y \Downarrow \nu}{\mathsf{And} \ x \ y \Downarrow \nu}(\mathsf{N}_6)$$

There is a question about ν^{-1} , understood to be defined by the following equations:

$$True^{-1} = False$$

 $False^{-1} = True$

Stacking Natural Deduction

Here is, as an example, one of the derivations of $1 \times 2 \times 3$ **PExp** from Week 2's slides:

	$2 \in \mathbb{Z}$	$3 \in \mathbb{Z}$
$1 \in \mathbb{Z}$	2 Atom	3 Atom
1 Atom	2 PExp	3 PExp
1 PExp	2×3 PExp	
$1 \times 2 \times 3$ PExp		

Part B

The small-step for $\mathcal L$ is characterised by the rules:

$$\frac{\mathbf{c} \mapsto \mathbf{c}'}{(\texttt{If } \mathbf{c} \ \mathbf{t} \ e) \mapsto (\texttt{If } \mathbf{c}' \ \mathbf{t} \ e)}(1) \quad \frac{}{(\texttt{If } \texttt{True } \mathbf{t} \ e) \mapsto \mathbf{t}}(2) \quad \frac{}{(\texttt{If } \texttt{False } \mathbf{t} \ e) \mapsto e}(3)$$

The question is about $e \Downarrow \nu$ and $e \stackrel{\star}{\mapsto} \nu$.

Part D

Here is a term in λ -calculus:

 $(\lambda n. \lambda f. \lambda x. (n f (f x))) (\lambda f. \lambda x. f x)$

The question is about $\beta\text{-reduction}$ and $\eta\text{-reduction}.$

Part E

Here's some concrete syntax:

let
$$g(x) = \neg x$$
 in
$$g(\mathsf{True})$$
 end