6-1

$M, N := X \mid \lambda X.M \mid (M\ N) \mid b \in B \mid o^n\ M_{\dots n}$

$V := \lambda X.M \mid b$

$\beta_v : (\lambda X.M)\ V \to M[X \leftarrow V]$

$\Delta : (o^n\ b_{\dots n}) \to \delta(o^n, b_{\dots n})$

$v = \beta_v \vee \Delta$

$C = \square \mid \lambda X.C \mid C\ N \mid M\ C \mid o^n\ M_{\dots}\ C\ M_{\dots}$

$M \vee N$

$C[M] \to_v C[N]$

$C = ((\square + (3+4)) + ((5+6) + (7+8)))$

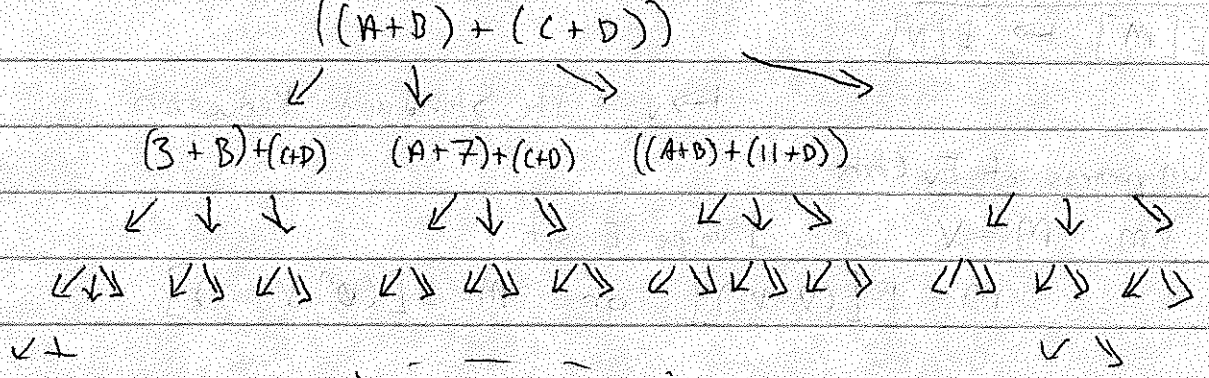
$(1+2) \vee 3$

A B C D

$((1+2) + (3+4)) + ((5+6) + (7+8))$ $\quad X =_v Y ?$

$\downarrow^v$

$(3 + (3+4)) + ((5+6) + (7+8))$



$eval(M) := b$ if $M =_v b$ $\quad M \to_v^* b$

'fun if $M =_v \lambda X.M$ $\quad M \to_v^* \lambda X.M$

6-2/

$$\frac{M \to_v N}{C[M] \to_v C[N]} \qquad C = \blacksquare \mid \lambda X.\, C \mid C\ N \mid M\ C \mid o^n\ M \ldots C \ldots$$

$P = (\lambda X.\ 3+4)\ 7$ $\quad C = \blacksquare$ $\quad M = (\lambda X.\ 3+4)\ 7$ $\quad N = 3+4$

$C = ((\lambda X.\ \blacksquare)\ 7)$ $\quad M = 3+4$ $\quad N = 7$

$\Rightarrow_v$ $\quad \mapsto_v$ $\quad \sqcup$ $\quad \sqcup$ $\quad \sqcup$ $\quad \sqcup$ $\quad \sqcup$

eqn theory $\qquad$ assembly

$$\frac{X = y}{X + Z = y + Z} \qquad \frac{}{0 = 0}$$

$(\lambda F.\ 7)\ (\lambda X.\ \Omega) \Rightarrow (\lambda F.\ 7)\ (\lambda X.\ \Omega)$

$C = (\lambda F.\ 7)\ (\lambda X.\ \blacksquare]$ $\quad M = \Omega$ $\quad N = \Omega$

$\downarrow$

7

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evaluation context

$$\frac{M \to_v N}{E[M] \mapsto_v E[N]} \qquad E = \blacksquare \mid \quad \mid E\ N \mid V\ E \mid o^n\ V \ldots E\ M \ldots$$

$\mapsto_v$:= The Standard Reduction

Uniqueness of Ev Ctxts

$\forall m.\ M = V$ or $\exists$ unique E s.t.

$M = E[(V_1\ V_2)]$ or $M = E[(o^n\ V \ldots)]$

$P = T \ldots$ M=rem limit

$T = m$

$[b]\ T \Rightarrow T'\ [b']$

$[b]\ P_1\ T\ P_2 \to [b]\ P_1\ T'\ P_2$

Correctness

$\forall m, \forall u.\ m \Rightarrow_v u$ iff $m \mapsto_v V$ and $V \Rightarrow_? u$

(old) (new) (old)

(7 3) Stuck terms

$M = (b\ V)$ or $M = (o^n\ b \ldots\ (\lambda X.m)\ V \ldots)$

$M = (o^n\ b \ldots)$ and $\delta(o^n, b \ldots)$ is undefined e.g. ~~0~~ 1/0

eval(M) =

Uniform Evaluation Theorem

If M has no free variables, then or

1. $M \mapsto_v V$
2. $m \mapsto_v N$ and N is stuck
3. $\forall N.\ m \mapsto_v N,\ \exists L.\ N \mapsto_v L$