

ACTIVITY-2

Name: Bhukya Vasanth Kumar

Roll: B180441CS

CSE - A Batch

operational semantics (small step) for given language:

and true $t \rightarrow t$

and false $t \rightarrow \text{false}$

$t_1 \rightarrow t_1'$

and $t_1 t_2 \rightarrow \text{and } t_1' t_2$

not true $\rightarrow \text{false}$

not false $\rightarrow \text{true}$

$t_0 \rightarrow t_0'$

not $t_0 \rightarrow \text{not } t_0'$

(E-AND TRUE)

(E-AND FALSE)

(E-AND I)

(E-NOT TRUE)

(E-NOT FALSE)

(E-NOT I)

Proof of Determinacy of 1-step evaluation:

Assume property holds for all smaller derivations

The last rule used in $t \rightarrow t'$.

1) E-AND TRUE

2) E-AND FALSE

3) E-AND I

4) E-NOT TRUE

5) E-NOT FALSE

6) E-NOT I

Case 1:

$t = \text{and } t_1 t_2$ where $t_1 = \text{true}$.

The last rule used in $t \rightarrow t'$ should also be E-AND TRUE.

(\therefore only 1 rule matches)

$\Rightarrow \therefore t' = t''$

Case 2

$t = \text{and } t_1 t_2$ where $t_1 = \text{false}$

Last rule applied for $t \rightarrow t'$ should also be E-AND FALSE.

(\therefore 1 rule only matches).

$\Rightarrow \therefore t' = t'' = \text{false}$

Case 3:

$t = \text{and } t_1 t_2$ where $t_1 \rightarrow t_1'$

Last rule applied for $t \rightarrow t''$ should also be F AND 1
(\therefore 1 rule only matches) with $t_1 \rightarrow t_1''$.

$$\begin{aligned} t_1' &= t_1'' \\ \text{and } t_1 t_2 &= \text{and } t_1'' t_2 \\ t_1 &= t_1'' \end{aligned}$$

} By Induction hypothesis applied to subterms

Case 4: $t = \text{not } t_1$ ($t_1 = \text{true}$)

last rule applied for $t \rightarrow t''$ is same (F - NOT TRUE)

$$\therefore t_1 = t_1'' = \text{false}$$

Case 5:

$t = \text{not } t_1$ ($t_1 = \text{false}$)

last rule applied for $t \rightarrow t''$ is same (F - NOT FALSE)

$$\therefore t_1 = t_1'' = \text{true}$$

Case 6:

$t = \text{not } t_1$ where $t_1 \rightarrow t_1'$

Last rule applied for $t \rightarrow t''$ should be also F-NOT 1

(\therefore only 1 rule matches with $t \rightarrow t_1''$)

By Induction Hypothesis applied to subterms

$$\begin{aligned} t_1' &= t_1'' \\ \text{not } t_1' &= \text{not } t_1'' \\ t_1 &= t_1'' \end{aligned}$$