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§5. Dynamic Behavior of Programs

5.1 Creation

In the beginning, we must create two sets $\mathbb{Q}_o$ and $\mathbb{V}_o$.

5.1.1 All <expression>'s in standard <declaration>'s are rewritten in the form of normal (as defined in the next paragraph).

5.1.2 Let $\mathbb{V}_o$ stand for the set of the all <identifier>'s declared by some standard <declaration>, and let $\alpha(V)$ be <u>able</u>, and $q(V)$ be an abstract element, different from each other, for each <variable> V in $\mathbb{V}_o$.

5.1.3 Let $\mathbb{Q}_o$ stand for the set

$$\{ q(V) \mid V \in \mathbb{V}_o \},$$

and let $v(Q)$ be the value of Q for each $Q \in \mathbb{Q}_o$.

(If standard <declaration> of a <variable> $V \in \mathbb{V}_o$ is of the form

"<u>let</u> V <u>be</u> <u>procedure</u> $(T_1, \ldots, T_n)T$ <u>by</u> $((V_1, \ldots, V_n)E)$"

and $q(V) = Q$, then

$v(Q)$ is $(V_1, \ldots, V_n)E$.)

5.1.4 Let Q0 stand for an abstract element $\notin \mathbb{Q}_o$, and let L0 stand for a <label>.

5.2 Normalization

Let E_1 stand for a legal program, $\mathbb{V}_1$ stand for the set of the all <identifier>'s contained in E_1, and $\mathbb{L}_1$ stand for the set of the all <label>'s contained in E_1.

1) Let $\mathbb{V}$ stand for $\mathbb{V}_o \cup \mathbb{V}_1$, and let $\alpha(V)$ be <u>inable</u> for $V \in \mathbb{V} - \mathbb{V}_o$.

2) Let $\mathbb{L}$ stand for $\mathbb{L}_1 \cup \{L0\}$.

3) Let $\mathbb{Q}$ stand for $\mathbb{Q}_o \cup \{Q0\}$, and let $v(Q0)$ be <u>done</u>.

4) $\gamma(E_1) \Rightarrow E_2$.

5) Let D be a <form declaration> in E_2 of the form

"<u>let</u> G <u>represent</u> F"

with a <form> G and an <expression> F.

$$q(\mathbb{V}) \Rightarrow V ;$$

Replace in E_2 D with

"let V be F ;

let G represent V ; ".

6) Let E' be a ⟨form call⟩ in E_2, of the form

" $P_o E_1{}' P_1 E_2{}' P_2 \ldots\ldots P_{n-1} E_n{}' P_n$ "

where $E_1{}'$, ..., $E_n{}'$ be ⟨expression⟩'s and P_i be empty or a sequence of ⟨mark⟩'s for i = 0, 1, ..., n. If the operator form $(P_o t(E_1{}')P_1 t(E_2{}')P_2 \ldots\ldots P_{n-1} t(E_n{}')P_n)$ is declared by a declaration of the form

"let G represent F",

then, replace E' in E_2 with

"(F)($E_1{}'$, ..., $E_n{}'$)".

7) When T is a ⟨typifier⟩ in E_2, replace T in E_2 with t(T).

8) Eliminate all ⟨form declaration⟩ and ⟨mark declaration⟩ in E_2, and let E stand for the result.

An ⟨expression⟩ of the form as E is called normal.

5.3 Elaboration of a Normal Program

$$e(E) ;$$

if the result is a quantity Q, then the elaboration of E is thus completed, but if the result is a ⟨label⟩ L, then the elaboration of E is undefined.