Algorithm for finding *non-ndg* locations

Non-ndg locations

Let X be the smallest set such that:

//defined symbols on the left

- $\{(\alpha, L, \tau) \mid \alpha = l \to r \in \mathfrak{R},\ \tau \in pos(l) \setminus \{\varepsilon\},\ root(l|_{\tau}) \in D\} \subseteq X$

//duplicated variables on the right

- $\{(\alpha, R, \tau) \mid \alpha = l \to r \in \mathfrak{R},\ \tau, \pi \in pos(r),\ \tau \neq \pi,\ r|_{\tau} = r|_{\pi} \in V\} \subseteq X$

//data flows in the same rules

- $\{(\alpha, L, \tau) \mid \alpha = l \to r \in \mathfrak{R},\ \tau \in pos(l),\ \pi \in pos(r), l|_{\tau} = r|_{\pi} \in V\} \subseteq X$, $if\ (\alpha, R, \pi) \in X$

//data flows in (separate) rules

- $\{(\alpha, R, \tau) \mid \alpha = l \to r \in \mathfrak{R},\ \tau \in pos(r),\ \tau = \pi.\upsilon,$

  $\beta = s \to t \in \mathfrak{R},\ \exists\, MGU\ for\ r|_{\pi}\ and\ s,\ \omega \in pos(s),\ \upsilon \nparallel \omega\} \subseteq X,\ if\ (\beta, L, \omega) \in X$

//return positions of marked defined symbols

- $\{(\alpha, R, \tau) \mid \alpha = l \to r \in \mathfrak{R},$

  $\beta = s \to t \in \mathfrak{R},\ root(l) = root(t|_{\pi}) \in D,\ \tau \in pos(r)\} \subseteq X,\ if\ (\beta, R, \pi) \in X$

Definedness-Tag

Let Y be the smallest set such that:

//defined symbols on the right that flow into variables on the left

- $\{(\alpha, R, \tau) \mid \alpha = l \to r \in \mathfrak{R},\ \tau \in pos(r),\ \tau = \pi.\upsilon,\ r|_{\tau} \in D,$

  $\beta = s \to t \in \mathfrak{R},\ \ \exists\, MGU\ for\ l|_{\pi}\ and\ s,\ \omega \in pos(s),\ s|_{\omega} \in V,\ \upsilon \nparallel \omega\} \subseteq Y$

//data flows in (separate) rules

- $\{(\beta, L, \omega) \mid \alpha = l \to r \in \mathfrak{R},\ \tau \in pos(r),\ \tau = \pi.\upsilon,$

  $\beta = s \to t \in \mathfrak{R},\ \ \exists\, MGU\ for\ l|_{\pi}\ and\ s,\ \omega \in pos(s),\ s|_{\omega} \in V,\ \upsilon \nparallel \omega\} \subseteq Y, if\ {\scriptstyle (\alpha, R, \tau) \in Y}$

//data flows in same rules

- $\{(\alpha, R, \tau) \mid \alpha = l \to r \in \mathfrak{R},\ \pi \in pos(l), \tau \in pos(r),\ \ l|_{\pi} = r|_{\tau} \in V\} \subseteq Y, if\ (\alpha, L, \pi) \in Y$

Final result

$F := X \cap Y$