PARTIAL EVALUATION TRANSFORMATION

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Partially Evaluate Non-Recursive Function

old function : $f(x,y) \triangleq e(x,y)$

$y \triangleq \tilde{y}$ — $\tilde{y}$ ground term

new function : $f'(x) \triangleq e(x,\tilde{y})$

$\vdash \boxed{ff'}$ $y=\tilde{y} \Longrightarrow f(x,\tilde{y}) = f'(x)$ — trivial, by δ_f and $\delta_{f'}$

optimize f' via successive transformations

$\boxed{\surd f}$ $\gamma_{\gamma_f}(x,y) \wedge [\gamma_f(x,y) \Rightarrow \gamma_e(x,y)]$

$\gamma_{f'}(x) \triangleq \gamma_f(x,\tilde{y})$

$\vdash \boxed{\surd f'}$ $\omega_{f'}(x)$

$\omega_{f'}(x) = \underbrace{\cancel{\gamma_{\gamma_f}(x,\tilde{y})}}_{\surd f} \wedge [\gamma_f(x,\tilde{y}) \Rightarrow \overset{\surd f}{\cancel{\gamma_e(x,\tilde{y})}}]$

QED

guards

$x \rightarrow x_1, \dots, x_n$

$y \rightarrow y_1, \dots, y_m$

$\tilde{y} \rightarrow \tilde{y}_1, \dots, \tilde{y}_m$

generalization to more parameters $(m \neq 0)$

Partially Evaluate Recursive Function

old function : $f(x,y) \triangleq \dots f \dots$

$y \triangleq \tilde{y}$ — $\tilde{y}$ ground term

new function : $f'(x) \triangleq f(x,\tilde{y})$ — non-recursive — preliminary simple approach

$\vdash \boxed{ff'}\ y = \tilde{y} \Longrightarrow f(x,\tilde{y}) = f'(x)$ — trivial, by $\delta_{f'}$

optimize f' via successive transformations, which may unfold the recursion completely if driven by y

$\boxed{\surd f}\ \gamma_{\surd f}(x,y) \wedge \dots$

$\gamma_{f'}(x) \triangleq \gamma_f(x,\tilde{y})$

$\vdash \boxed{\surd f'}\ \omega_{f'}(x)$

$\omega_{f'}(x) = \underset{\surd f}{\cancel{\gamma_{\surd f}(x,\tilde{y})}} \wedge \left[\gamma_f(x,\tilde{y}) \Rightarrow \cancel{\gamma_f(x,\tilde{y})}\right]$

QED

guards

generalization to more parameters as in non-recursive case