

$\Psi \vdash e : \sigma$	$\Psi ::= \emptyset \mid \Psi, x : \sigma$	
S-T-VAR $\frac{x : \sigma \in \Psi}{\Psi \vdash x : \sigma}$	S-T-ABS $\frac{\Psi, x : \sigma_1 \vdash e : \sigma_2}{\Psi \vdash \lambda x.e : \sigma_1 \rightarrow \sigma_2}$	S-T-APP $\frac{\Psi \vdash e_1 : \sigma_2 \rightarrow \sigma \quad \Psi \vdash e_2 : \sigma_2}{\Psi \vdash e_1(e_2) : \sigma}$
S-T-STRINGIN-I $\frac{s \in \mathcal{L}\{r\}}{\Psi \vdash \text{rstr}[s] : \text{stringin}[r]}$	S-T-CONCAT $\frac{\Psi \vdash e_1 : \text{stringin}[r_1] \quad \Psi \vdash e_2 : \text{stringin}[r_2]}{\Psi \vdash \text{rconcat}(e_1; e_2) : \text{stringin}[r_1 \cdot r_2]}$	
S-T-CASE $\frac{\Psi \vdash e_2 : \sigma \quad \Psi, x : \text{stringin}[\text{head}(r)] , y : \text{stringin}[\text{tail}(r)] \vdash e_3 : \sigma}{\Psi \vdash \text{rstrcase}(e_1; e_2; x, y, e_3) : \sigma}$		
S-T-REPLACE $\frac{\Psi \vdash e_1 : \text{stringin}[r_1] \quad \Psi \vdash e_2 : \text{stringin}[r_2] \quad \text{lreplace}(r; r_1; r_2) = r'}{\Psi \vdash \text{rreplace}[r](e_1; e_2) : \text{stringin}[r']}$		
S-T-SAFECOERCE $\frac{\Psi \vdash e : \text{stringin}[r'] \quad \mathcal{L}\{r'\} \subseteq \mathcal{L}\{r\}}{\Psi \vdash \text{rcoerce}[r](e) : \text{stringin}[r]}$		
S-T-CHECK $\frac{\Psi \vdash e_0 : \text{stringin}[r_0] \quad \Psi, x : \text{stringin}[r] \vdash e_1 : \sigma \quad \Psi \vdash e_2 : \sigma}{\Psi \vdash \text{rcheck}[r](e_0; x, e_1; e_2) : \sigma}$		

$e \Downarrow v$		
S-E-ABS $\lambda x.e \Downarrow \lambda x.e$	S-E-APP $\frac{e_1 \Downarrow \lambda x.e_3 \quad e_2 \Downarrow v_2 \quad [v_2/x]e_3 \Downarrow v}{e_1(e_2) \Downarrow v}$	S-E-RSTR $\text{rstr}[s] \Downarrow \text{rstr}[s]$
S-E-CONCAT $\frac{e_1 \Downarrow \text{rstr}[s_1] \quad e_2 \Downarrow \text{rstr}[s_2]}{\text{rconcat}(e_1; e_2) \Downarrow \text{rstr}[s_1 s_2]}$	S-E-CASE-ϵ $\frac{e_1 \Downarrow \text{rstr}[e] \quad e_2 \Downarrow v_2}{\text{rstrcase}(e_1; e_2; x, y, e_3) \Downarrow v_2}$	
S-E-CASE-CONCAT $\frac{e_1 \Downarrow \text{rstr}[a.s] \quad [\text{rstr}[a], \text{rstr}[s]/x, y]e_3 \Downarrow v_3}{\text{rstrcase}(e_1; e_2; x, y, e_3) \Downarrow v_3}$		
S-E-REPLACE $\frac{e_1 \Downarrow \text{rstr}[s_1] \quad e_2 \Downarrow \text{rstr}[s_2] \quad \text{subst}(r; s_1; s_2) = s}{\text{rreplace}[r](e_1; e_2) \Downarrow \text{rstr}[s]}$	S-E-SAFECOERCE $\frac{e \Downarrow \text{rstr}[s]}{\text{rcoerce}[r](e) \Downarrow \text{rstr}[s]}$	
S-E-CHECK-OK $\frac{e \Downarrow \text{rstr}[s] \quad s \in \mathcal{L}\{r\} \quad [\text{rstr}[s]/x]e_1 \Downarrow v}{\text{rcheck}[r](e; x, e_1; e_2) \Downarrow v}$		
S-E-CHECK-NOTOK $\frac{e \Downarrow \text{rstr}[s] \quad s \notin \mathcal{L}\{r\} \quad e_2 \Downarrow v}{\text{rcheck}[r](e; x, e_1; e_2) \Downarrow v}$		

Figures 3 and 4: Typing Rules and Big step semantics for λ_{RS}

$\langle \sigma \rangle ::= \frac{\sigma \rightarrow \sigma}{\text{stringin}[r]}$	source types
$\langle e \rangle ::= \begin{array}{l} x \\ \lambda x.e \\ e(e) \\ \text{rstr}[s] \\ \text{rconcat}(e; e) \mid \text{rstrcase}(e; e; x, y, e) \\ \text{rreplace}[r](e; e) \\ \text{rcoerce}[r](e) \mid \text{rcheck}[r](e; x, e; e) \end{array}$	source terms $s \in \Sigma^*$
$\langle v \rangle ::= \lambda x.e \mid \text{rstr}[e] \mid s$	source values
$\langle \tau \rangle ::= \frac{\tau \rightarrow \tau}{\text{string} \mid \text{regex}}$	target types
$\langle \iota \rangle ::= \begin{array}{l} x \\ \lambda x.\iota \\ \iota(\iota) \\ \text{str}[s] \\ \text{rx}[r] \mid \text{concat}(\iota; \iota) \mid \text{strcase}(\iota; \iota; x, y, \iota) \mid \text{replace}(\iota; \iota; \iota) \mid \text{check}(\iota; \iota; \iota) \end{array}$	target terms
$\langle \dot{v} \rangle ::= \lambda x.\iota \mid \text{str}[s] \mid \text{rx}[r]$	target values

Figures 2 and 5: Syntax of λ_{RS} and λ_P .

$\Theta \vdash \iota : \tau$	$\Theta ::= \emptyset \mid \Theta, x : \tau$	
P-T-VAR $\frac{x : \tau \in \Theta}{\Theta \vdash x : \tau}$	P-T-ABS $\frac{\Theta, x : \tau_1 \vdash \iota_2 : \tau_2}{\Theta \vdash \lambda x.\iota_2 : \tau_1 \rightarrow \tau_2}$	P-T-APP $\frac{\Theta \vdash \iota_1 : \tau_2 \rightarrow \tau \quad \Theta \vdash \iota_2 : \tau_2}{\Theta \vdash \iota_1(\iota_2) : \tau}$
P-T-STRING $\Theta \vdash \text{str}[s] : \text{string}$	P-T-REGEX $\Theta \vdash \text{rx}[r] : \text{regex}$	P-T-CONCAT $\frac{\Theta \vdash \iota_1 : \text{string} \quad \Theta \vdash \iota_2 : \text{string}}{\Theta \vdash \text{concat}(\iota_1; \iota_2) : \text{string}}$
P-T-CASE $\frac{\Theta \vdash \iota_1 : \text{string} \quad \Theta \vdash \iota_2 : \tau \quad \Theta, x : \text{string}, y : \text{string} \vdash \iota_3 : \tau}{\Theta \vdash \text{strcase}(\iota_1; \iota_2; x, y, \iota_3) : \tau}$		
P-T-REPLACE $\frac{\Theta \vdash \iota_1 : \text{regex} \quad \Theta \vdash \iota_2 : \text{string} \quad \Theta \vdash \iota_3 : \text{string}}{\Theta \vdash \text{replace}(\iota_1; \iota_2; \iota_3) : \text{string}}$		
P-T-CHECK $\frac{\Theta \vdash \iota_r : \text{regex} \quad \Theta \vdash \iota_1 : \text{string} \quad \Theta \vdash \iota_2 : \sigma \quad \Theta \vdash \iota_3 : \sigma}{\Theta \vdash \text{check}(\iota_r; \iota_1; \iota_2; \iota_3) : \sigma}$		

$\iota \Downarrow \dot{v}$		
P-E-ABS $\lambda x.e \Downarrow \lambda x.e$	P-E-APP $\frac{\iota_1 \Downarrow \lambda x.\iota_3 \quad \iota_2 \Downarrow \dot{v}_2 \quad [\dot{v}_2/x]\iota_3 \Downarrow \dot{v}_3}{\iota_1(\iota_2) \Downarrow \dot{v}_3}$	P-E-STR $\text{str}[s] \Downarrow \text{str}[s]$
P-E-RX $\text{rx}[r] \Downarrow \text{rx}[r]$	P-E-CONCAT $\frac{\iota_1 \Downarrow \text{str}[s_1] \quad \iota_2 \Downarrow \text{str}[s_2]}{\text{concat}(\iota_1; \iota_2) \Downarrow \text{str}[s_1 s_2]}$	P-E-CASE-ϵ $\frac{\iota_1 \Downarrow \text{str}[e] \quad \iota_2 \Downarrow \dot{v}_2}{\text{strcase}(\iota_1; \iota_2; x, y, \iota_3) \Downarrow \dot{v}_2}$
	P-E-CASE-CONCAT $\frac{\iota_1 \Downarrow \text{str}[a.s] \quad [\text{str}[a], \text{str}[s]/x, y]\iota_3 \Downarrow \dot{v}}{\text{strcase}(\iota_1; \iota_2; x, y, \iota_3) \Downarrow \dot{v}}$	
P-E-REPLACE $\frac{\iota_1 \Downarrow \text{rx}[r] \quad \iota_2 \Downarrow \text{str}[s_2] \quad \iota_3 \Downarrow \text{str}[s_3] \quad \text{subst}(r; s_2; s_3) = s}{\text{replace}(\iota_1; \iota_2; \iota_3) \Downarrow \text{str}[s]}$		
P-E-CHECK-OK $\frac{\iota_r \Downarrow \text{rx}[r] \quad \iota \Downarrow \text{str}[s] \quad s \in \mathcal{L}\{r\} \quad \iota_1 \Downarrow \dot{v}_1}{\text{check}(\iota_r; \iota; \iota_1; \iota_2) \Downarrow \dot{v}_1}$		
P-E-CHECK-NOTOK $\frac{\iota_r \Downarrow \text{rx}[r] \quad \iota \Downarrow \text{str}[s] \quad s \notin \mathcal{L}\{r\} \quad \iota_2 \Downarrow \dot{v}_2}{\text{check}(\iota_r; \iota; \iota_1; \iota_2) \Downarrow \dot{v}_2}$		

Figures 6 and 7: Typing rules and big step semantics for λ_P

$\llbracket \sigma \rrbracket = \tau$	TR-T-STRING $\frac{}{\llbracket \text{stringin}[r] \rrbracket = \text{string}}$	TR-T-ARROW $\frac{\llbracket \sigma_1 \rrbracket = \tau_1 \quad \llbracket \sigma_2 \rrbracket = \tau_2}{\llbracket \sigma_1 \rightarrow \sigma_2 \rrbracket = \tau_1 \rightarrow \tau_2}$
$\llbracket \Psi \rrbracket = \Theta$	TR-T-CONTEXT-EMP $\frac{}{\llbracket \emptyset \rrbracket = \emptyset}$	TR-T-CONTEXT-EXT $\frac{\llbracket \Psi \rrbracket = \Theta \quad \llbracket \sigma \rrbracket = \tau}{\llbracket \Psi, x : \sigma \rrbracket = \Theta, x : \tau}$
$\llbracket e \rrbracket = \iota$	TR-VAR $\frac{}{\llbracket x \rrbracket = x}$	TR-ABS $\frac{\llbracket e \rrbracket = \iota}{\llbracket \lambda x.e \rrbracket = \lambda x.\iota}$
	TR-APP $\frac{\llbracket e_1 \rrbracket = \iota_1 \quad \llbracket e_2 \rrbracket = \iota_2}{\llbracket e_1(e_2) \rrbracket = \iota_1(\iota_2)}$	
	TR-CASE $\frac{\llbracket e_1 \rrbracket = \iota_1 \quad \llbracket e_2 \rrbracket = \iota_2 \quad \llbracket e_3 \rrbracket = \iota_3}{\llbracket \text{rstrcase}(e_1; e_2; x, y, e_3) \rrbracket = \text{strcase}(\iota_1; \iota_2; x, y, \iota_3)}$	TR-STRING $\frac{}{\llbracket \text{rstr}[s] \rrbracket = \text{str}[s]}$
	TR-CONCAT $\frac{\llbracket e_1 \rrbracket = \iota_1 \quad \llbracket e_2 \rrbracket = \iota_2}{\llbracket \text{rconcat}(e_1; e_2) \rrbracket = \text{concat}(\iota_1; \iota_2)}$	TR-SUBST $\frac{\llbracket e_1 \rrbracket = \iota_1 \quad \llbracket e_2 \rrbracket = \iota_2}{\llbracket \text{rreplace}[r](e_1; e_2) \rrbracket = \text{replace}(\text{rx}[r]; \iota_1; \iota_2)}$
TR-SAFECOERCE $\frac{}{\llbracket \text{rcoerce}[r'](e) \rrbracket = \iota}$	TR-CHECK $\frac{\llbracket e \rrbracket = \iota \quad \llbracket e_1 \rrbracket = \iota_1 \quad \llbracket e_2 \rrbracket = \iota_2}{\llbracket \text{rcheck}[r](e; x, e_1; e_2) \rrbracket = \text{check}(\text{rx}[r]; \iota; (\lambda x.\iota_1)(\iota_2)}$	

Figure 8: Translation from source terms (e) to target terms (ι).