Elif Cemre Durgut - 26493 - CS302 HW8

Question 3

i) $(s, \#w) \vdash^*_m (h, \#w^R)$

Test : $w = abb$ $w^R = bba$

$(\underline{\#}abb) R_\# \rightarrow (\#abb\underline{\#}) L \rightarrow (\#ab\underline{b}) x \rightarrow (\#a\underline{b}x) R_\# \rightarrow (\#ab\underline{x}\#) b$

$\rightarrow (\#abx\underline{b}) L_x \rightarrow (\#ab\underline{x}b) L \rightarrow (\#a\underline{b}xb) x \rightarrow (\#\underline{a}xxb) R_\# \rightarrow (\#axxb\underline{\#}) b$

$\rightarrow (\#axxb\underline{b}) L_x \rightarrow (\#ax\underline{x}bb) LL \rightarrow (\#\underline{a}xxbb) x \rightarrow (\#xxxbb) R_\# \rightarrow (\#xxxbb\underline{\#}) a$

$\rightarrow (\#xxxbb\underline{a}) L_\# \rightarrow (\#\underline{x}xxbba) \# \rightarrow (\#\underline{\#}xxbba) R_x \rightarrow (\#\#\underline{x}xbba) \#$

$\rightarrow (\#\#\underline{\#}xbba) R_x \rightarrow (\#\#\#\underline{x}bba) \# \rightarrow (\#\#\#\#bba)$ ✓

Label	Condition	Next TM
>	-	$R_\# L B$
B	$\sigma \neq \#$	$x R_\# \sigma L_x C$
C	$\sigma_1 \neq x$	L
B	$\sigma = \#$	h

→ go left until you find the first non-x. (Loop) from right to left

ii) $(s, \#w) \vdash^*_m (h, \#ww)$

Test: $w = abb$ $f(w) = abbabb$

$(\underline{\#}abb) R \rightarrow (\#\underline{a}bb) x \rightarrow (\#\underline{x}bb) R_\# \rightarrow (\#xbb\underline{\#}) a \rightarrow (\#xbba) L_x$

$\rightarrow (\#\underline{x}bba) a \rightarrow (\#\underline{a}bba) R \rightarrow (\#a\underline{b}ba) x (\#a\underline{x}ba) R_\# \rightarrow (\#axba\underline{\#}) b$

$\rightarrow (\#axba\underline{b}) L_x \rightarrow (\#a\underline{x}bab) b \rightarrow (\#a\underline{b}bab) R \rightarrow (\#ab\underline{b}ab) x \rightarrow (\#ab\underline{x}ab) R_\#$

$\rightarrow (\#abxab\underline{\#}) b \rightarrow (\#abxabb) L_x \rightarrow (\#ab\underline{x}abb) b \rightarrow (\#abbabb)$

L	C	Next
>	-	$R x R_\# \sigma L_x \sigma$

iii) $(s, \#w) \vdash^*_m (h, \#w\#w^R)$

Test: $w = abb$ $f(w) = abb\#bba$

$(\underline{\#}abb)R_\# \to (\#abb\underline{\#})X \to (\#abb\underline{x})L \to (\#ab\underline{b}x)X \to (\#a\underline{b}xx)R_\#$

$\to (\#abxx\underline{\#})b \to (\#abxx\underline{b})L_\# \to (\underline{\#}abxxb)R_X \to (\#a\underline{b}xxb)b$

$\to (\#ab\underline{b}xb)L \to (\#a\underline{b}bxb)X \to (\#a\underline{x}bxb)R_\# \to (\#axbxb\underline{\#})b$

$\to (\#axbxb\underline{b})L_\# \to (\underline{\#}axbxbb)R_X \to (\#a\underline{x}bxbb)b \to (\#a\underline{b}bxbb)L \to$

$\to (\#\underline{a}bbxbb)X \to (\#\underline{x}bbxbb)R_\# \to (\#xbbxbb\#)a \to (\#xbbxbba)L_\# \to$

$\to (\underline{\#}xbbxbba)R_X \to (\#\underline{x}bbxbba)a \to (\#\underline{a}bbxbba)L \to (\underline{\#}abbxbba)$

$\to$ halt

Label	condition	Next TM
>	←	$R_\# X L B$
B	$\sigma \neq \#$	$X R_\# \sigma L_\# R_X \sigma L B$
B	$\sigma = \#$	h