Design a Turing Machine which would compute the following function:
(s, ◇#<x>, ◇#<y>) |--* (h, ◇#<x ~ y>, ◇#y) where <x(y)> stands for the binary encoded integer x(y), and x ~ y = x - y if x > y; 0 otherwise.

TM	Condition	Next TM
>A	—	$R^1_\# \, R^2_\# . L^1 . L^2 . B$
B	$\sigma^1 \sigma^2 = 00 \vee 11$	$0^1 . L^1 . L^2 . B$
	$\sigma^1 \sigma^2 = 10$	$1^1 . L^1 . L^2 . B$
	$\sigma^1 \sigma^2 = 01$	$x^1 . L^1 . L^2 . C$
	$\sigma^1 = \# \wedge \sigma^2 = \#$	h
	$\sigma^1 = \# \wedge \sigma^2 \neq \#$	D
	$\sigma^1 \neq \# \wedge \sigma^2 = \#$	$L^1_\# . h$

TM	Condition	Next TM
C	$\sigma^1 = 0$	$1^1 . L^1 . C$
	$\sigma^1 = 1$	$0^1 . R^1_x . 1^1 . L^1 . B$
	$\sigma^1 = \#$	$R^1_\# . L^1 . E$
D	$\sigma^2 = 0$	$L^2 . D$
	$\sigma^2 = 1$	$L^2_\# . R^1_\# . L^1 . E$
	$\sigma^2 = \#$	h
E	$\sigma^1 \neq \#$	$\#^1 . L^1 . E$
	$\sigma^1 = \#$	$R^1 . 0^1 . L^1 . h$

Let **M$_1$** and **M$_2$** be single tape DTMs that decide the languages **L$_1$** and **L$_2$** respectively. Construct using a tabular format a 2-tape NDTM **M** that decides the language **L$_1$.L$_2$**.

(Assumptions: 1- **M$_1$** and **M$_2$** decide the languages with final configurations (h$_{yes}$, ◇#) or (h$_{no}$, ◇#)

2- If **X** and **Y** are DTMs that decide languages then **X.Y** is defined as the sequential composition where control passes from **X** to **Y** *iff* **X** reaches the state h$_{yes}$.)

$$(s, \Diamond \underline{\#} \, w \, , \, \Diamond \underline{\#})$$

$$w = x \cdot y$$

TM	Condition	Next TM
> A	—	R'.B
B	$\sigma' = x \neq \#$	R'.B
	$\sigma' = x \neq \#$	$R^2.x^2.\#'.R'.R^2.C$
	$\sigma' = \#$	$L'_\#.D$
C	$\sigma' = x \neq \#$	$x^2.\#'.R'.R^2.C$
	$\sigma' = \#$	$L^2_\#.L'_\Diamond.R'.D$

D	—	$M_1^1.M_2^2.h_{yes}$

If **M** is a Turing Machine that decides the language **L** where he assumptions of question 2 hold, construct using a tabular format a 2-tape NDTM **M'** that decides the language **L***.

$$\left(s, \Diamond \# \omega , \Diamond \# \right)$$

TM	Condition	Next TM
>A	—	$R^1.B$
B	$\sigma^1=\#$	h_{yes}
B	$\sigma^1\neq\#$	C
C	$\sigma^1=x\neq\#$	$R^1.C$
C	$\sigma^1=x\neq\#$	$R^2.x^2.R^1.R^2.D$
C	$\sigma^1=\#$	h_{no}
D	$\sigma^1=x\neq\#$	$x^2.R^1.R^2.D$
D	$\sigma^1=\#$	$L^1_\#.L^2_\#.R^1.R^2.E$
E	$\sigma^1=\sigma^2\neq\#$	$R^1.R^2.E$
E	$\sigma^1=\sigma^2=\#$	$L^1_\#.L^2_\#.M^2.h_{yes}$
E	$\sigma^1\neq\sigma^2\wedge\sigma^2\neq\#$	h_{no}
E	$\sigma^1\neq\sigma^2\wedge\sigma^2=\#$	$L^2_\#.R^2.E$