

HW10

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1. For union for L_1 and L_2 I have machines M_1 and M_2 . Given an input $x \in L_1 \cup L_2$ I give x to M_1 and M_2 and if its accepted by either machine that means they are accepted. Similar to intersection but both machines must be accepted. I would build this turring machine by getting two tape and with input x and then dove tailing the two tape into each relative turring machine. For example below is a representation of the tape where $b_1 = a_1$ and so on and so forth.

#	a1	a2	a3	an	#
#	b1	b2	b3	bn	#

For reversal I would simply copy the input from one side of the tape to the other in reverse order. I would then have the same turring machine dove tail both peices of tape and if both are accepted then the whole thing is accepted.

2. Given a string that $z = xy$ and you have M_1, M_2 . You create every possible combination of ways to divided up z onto multiple peices of tape. For example if $x = ab$ and $y = cd$ then you have

$T[a]_1 \dots T[bcd]_2$

$T[ab]_3 \dots T[cd]_4$

$T[abc]_5 \dots T[d]_6$

Where $T[\]_n$ is a peice of tape. M_1 dove tails for every odd indexed tape and M_2 does every even. If both of the machines have at least one accepting string then the whole thing is accepted.

3. a

For this turing machine it would depend on if it goes left, right, or does nothing

$\delta(a_n, a_n) = (a_{n+1}, R)$ and push (GO RIGHT)

$\delta(a_n, a_n) = (a_{n-1}, L)$ (GO LEFT)

$\delta(a_n, a_n) = (a_n, a_n)$ (Do Nothing)

b.

To prove that all languages accepted by PA's can be accepted by M we will prove that the accepted languages of $PA \subset M$. We can prove this because we can simulate a PA with M by starting the head on the left most data on the read only tape and only using Γ_1 and reading from left to right.

We can prove that it is equivalent to a turing machine because $M \subset T$ and $T \subset M$. In this case we can prove $M \subset T$ because a Turing machine can use two pieces of tape to simulate the two stacks and a third as the read only tape. We can also prove $T \subset M$. We can simulate a turing machine because we can put all the contents left of the head in Γ_1 . and to the right Γ_2 . If we want to move right we pop Γ_2 and left Γ_1 . Therefore they are equal. We also know that all languages accepted by any type of PA including NPDA or deterministic ones can also be accepted by a turing machine so that is another reason M can accept the same languages as a class of automata.