

PS08-03

February 23, 2018

- a. Union: In class, we discussed and proved that running a multi-tape machine that runs in $t(n)$ time will run on a single tape machine in $t(n)^2$ time. Therefore by running union on two tapes and accepting if one tape accepts, we can conclude that Machine M_U will run in $O(t(n)^2)$ time, thus showing that union is in P .
- b. intersection: In machine M , run x on M_1 . If it rejects, reject. If it accepts, run x on M_2 . If it accepts, accept.
- c. concatenation. Given input x , we need to split x into two substrings, x_1 and x_2 , then test if each is in each of the component languages. We start at $x_1 = \varepsilon$, and add chars to x_1 until $|x_1| = |x|$, so we end up running M_1 on x_1 and M_2 on x_2 $|x|$ times, resulting in an $O(n^{k+1})$ time.
- d. complement. Assuming that the language in question is decidable, machine M_{cmp} is identical to M , except that that the accept and reject states are switched. This runs in the same time.
- e. star