

Cpt S 317 Homework #0

Please print your name!

1. Consider the following two languages on alphabet $\Sigma = \{a, b\}$:

L_1 , the set of all words w on the alphabet such that w contains at least three a 's;

L_2 , the set of all words w on the alphabet such that w contains the same number of a 's and b 's.

Now, I have a robot M holding two flowers, *red* and *blue*, and, at each second, shows exactly one of the two. When the *red* is observed, this event is called a ; when the *blue* is observed, this event is called b . (The programs below may use some interrupt mechanism as I showed in class.)

(1). Please program the robot such that the set of all its observable behaviors is exactly L_1 ;

(2). Please program the robot such that the set of all its observable behaviors is exactly L_2 ;

(3). Please argue intuitively why you only need a fixed and finite amount memory for the program in (1) while you have to use an unbounded amount of memory for the program in (2).

(4). Because of the arguments established in (3), we are ready to conclude that L_2 is more complex than L_1 . Indeed, this is true. However, this conclusion does not imply that every word in L_2 is more complex than every word in L_1 . For instance, consider the following two words:

$$w_1 = aaababababaaabbaab \in L_1$$

$$w_2 = aaaaaaaaaabbbbbbbb \in L_2$$

It is “clear” that w_1 is more complex than w_2 , actually. In other words, we may need a completely new method in measuring the complexity of a single word (herein, I am not interested in measuring the complexity of a languages as in (3)). Please suggest a way to measure the complexity of a word.