Automata
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1-21-20

Homework 1

1) L_1 and L_2 are 2 languagues, and $L_1^* \cup L_2^* \subseteq (L_1 \cup L_2)^*$?
If I start with the understanding that $L_1 \subseteq (L_1 \cup L_2)$.
Assuming this we can then come to the realization that $L_1^* \subseteq (L_1 \cup L_2)^*$.
Likewise we can also assume that $L_2 \subseteq (L_1 \cup L_2)$.
With this second assumption it becomes clear also that $L_2^* \subseteq (L_1 \cup L_2)^*$.
Since both L_1^* and L_2^* are subsets of $(L_1 \cup L_2)^*$, it follows to reason that the union of them $L_1^* \cup L_2^*$ is also a subset of $(L_1 \cup L_2)^*$.
Hence: $L_1^* \cup L_2^* \subseteq (L_1 \cup L_2)^*$

2)
Let's say that there is a language L_1 which contains only {"x"} and another language L_2 which contains only {"y"}. Thus L_1^* is simply the set of all possible lengths of the string "xxxxx..." and the same holds true for L_2^* with the string "yyyy...". So with $L_1 \cup L_2$ we would have the Language {"x", "y"}, so $(L_1 \cup L_2)^*$ would contain both L_1^* and L_2^*, but it also would containt strings with both x and y which could not be made before, such as "xyxyx".

3) {0, 10, 1010, 01010,10010,10100…}
So S would have to be the Language {0, 10}