

CS3133

HW#3

DUE: Friday, September 10

1. (6 points) Give a regular expression for the following languages over $\{0,1\}$.

a The set of strings that contain 01 **and** 10. Note that 010 belongs to the language.

b Every 0 is **either** immediately preceded by a 1 **or** immediately followed by a 1.

2. (8 points) For the languages described by the regular expressions $\alpha = 0^* + 1^*$ and $\beta = 01^* + 10^* + 1^*0 + (0^*1)^*$, find a shortest string z satisfying each of the following conditions.

a $z \in L(\alpha)$ and $z \notin L(\beta)$.

b $z \notin L(\alpha)$ and $z \in L(\beta)$.

c $z \in L(\alpha) \cap L(\beta)$.

d $z \notin L(\alpha) \cup L(\beta)$.

3. (6 points) Letting α and β denote arbitrary regular expressions, find a shortest regular expression which is equivalent to each of the following.

a $\alpha(\alpha^*\alpha + \alpha^*) + \alpha^*$

b $(\alpha + \varepsilon)^*$

c $(\alpha + \beta)^* \alpha \beta (\alpha + \beta)^* + \beta^* \alpha^*$

4. (10 points) Describe an algorithm to convert an arbitrary regular expression α , such that $L(\alpha) \neq \emptyset$, to an equivalent regular expression β such that $L(\alpha) = L(\beta)$ and \emptyset does not appear in β .

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Solutions to HW#3

1. **a** Either the first 01 precedes the first 10 or the first 10 precedes the first 01.

$$0^*011^*0(0+1)^* + 1^*100^*1(0+1)^*$$

b $1^*(101^*+1^*01)^*1^*$

2. **a** 00

b 01

c ε

d 010

3. **a** α^*

b α^*

c $(\alpha + \beta)^*$

4. $\beta \leftarrow \alpha$

repeat

if $\emptyset + \chi$ or $\chi + \emptyset$ appears in β for some regular expression χ

then replace it by χ

if $\emptyset\chi$ or $\chi\emptyset$ appears in β for some regular expression χ

then replace it by \emptyset

if \emptyset^* appears in β **then** replace it by ε

until \emptyset does not appear in β