



CS5003
Quiz 0100

Foundations of C.S.

Spring, 2023

PRINT NAME: _____

SIGN: _____

1. (3 pts) Find a regular expression for the set of strings on $\{a, b, c\}$ which contain a^2 as a substring.

Justify your design in a few words.

♣ Design: This one everyone should get. Every such string decomposes as any initial string, followed by a^2 and then some terminal string. The fact that a string has many have several such decompositions is irrelevant. That is the nature of regular expressions.

$$(a \cup b \cup c)^* a^2 (a \cup b \cup c)^*$$

works fine. (The string $a^2 b a^3$ matches it in three ways, and $ababc$ doesn't match it at all.)

There are other correct solutions. ♣

2. (4 pts) Find a regular expression for the set of strings on $\{a, b, c\}$ which do not contain a^2 as a substring.

Justify your design in a few words.

♣ Design: Every non-final a must be followed by a non-empty string of b 's and c 's. So $(a(b \cup c)^+)^* a$ will match all such strings which start and end with a . To allow for other beginnings and endings, and those strings which have no a 's at all, we have:

$$(b \cup c)^* (a(b \cup c)^+)^* a (b \cup c)^* \cup (b \cup c)^*$$

There are other correct solutions. ♣

3. (3 pts) Find a regular expression for the set of strings on $\{a, b, c\}$ which do not contain either a^2 or b^2 as substrings.

Justify your design in a few words.

♣ Design: All substrings consisting of just a 's and b 's have to alternate back and forth. So $a(ba)^*(b \cup \lambda)$ if it starts with a , and $b(ab)^*(a \cup \lambda)$ if it starts with b . Such segments must be separated by a nonempty string of c 's, so

$((a(ba)^*(b \cup \lambda) \cup b(ab)^*(a \cup \lambda))c^+)^* (a(ba)^*(b \cup \lambda) \cup b(ab)^*(a \cup \lambda))$, and it may start or end with c 's. So the final expression is

$$c^* ((a(ba)^*(b \cup \lambda) \cup b(ab)^*(a \cup \lambda))c^+)^* (a(ba)^*(b \cup \lambda) \cup b(ab)^*(a \cup \lambda)) c^*,$$

There are other correct solutions. ♣