This quiz has 2 questions, for a total of 6 points.

Question 1 . . . . *3 points*

Given an alphabet $\Sigma = \{0, 1\}$, describe each one of the following languages by a regular expression.

(a) [1 point] The language of strings of length at least three that begin and end with different symbols.

$\cancel{(0\Sigma^*1) \cup (1\Sigma^*0)}$ $\quad (0\Sigma\Sigma^*1) \cup (1\Sigma\Sigma^*0)$ $\quad 1\Sigma^+0 + 0\Sigma^+1$ $\quad 0$

(b) [1 point] The language of strings that contain the substring 101.

$\cancel{\Sigma^* 101 \Sigma^*}$ $\quad \Sigma^* 101 \Sigma^*$ $\quad 1$

(c) [1 point] The language of strings that contain an odd number of 1's.

$\cancel{(0^* 1 0^* 1 0^*)^*}$ $\quad 0^* 1 (0^* 1 0^* 1 0^*)^* 0^*$

Question 2 .... *3 points*

Consider the alphabet $\Sigma = \{a, b, c\}$. Use the pumping lemma to prove that the language $L = \{a^{3n}b^{3n}c^{3n}, n \geq 0\}$ is not regular.

- Assume L is a regular Language
- Let P be the pumping length
- let S be a string $S \in L$, $S = a^{3P} b^{3P} c^{3P}$, $|S| = 3P \geq P$

Consider the decompositus of S into xyz while $\begin{cases} |xy| \leq P \\ |y| \geq 1 \end{cases}$

Consider decomposition $x = a^{3P-1}$, $y = a$, $z = b^{3P} c^{3P}$

let $i = 2 \longrightarrow x = a^{3P-1}$, $y = a^2$, $z = b^{3P} c^{3P}$

then $xy^2z \notin L$

$\therefore$ L is not regular

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