Assignment #3

Date Due: November 18, 2026

Total: 3 marks

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1. Describe in English, as simple as possible, the languages generated by the following regular expressions:
   (a) $bb^*b(a^* + b + a)^*$
   (b) $(a^* + b)^*a(a^*)^*a$
   (c) $(ab)^*ab(\varepsilon + a) + ba(ba)^*(b + \varepsilon)$
   (d) $b^*ab^*(b^*ab^*ab^*b^*ab^*ab^*ab^*)^*$.

2. Prove that the following languages are regular languages:
   (a) $L = \{a^n b^m a^k \mid n \geq 2, m \geq 3, k \geq 4\}$
   (b) $L = \{a^n \mid n \neq 3, \text{ and } n \not\equiv 2(\mod 5)\}$
   (c) $L = \{a^n b \mid n \geq 3\} \cup \{ab^m \mid m \geq 6\}$
   (d) Assume L_1 is a regular language and define $L = \{wcv \in \{a, b, c\}^* \mid (2|w|_a + 3|v|_b) \equiv 2 \mod 6,\ w, v \in L_1\}$,

3. Are the following languages regular or not?
   (a)
   $$\{a^n b^l a^m \mid |n - m| \leq 1, l > 4\}.$$
   (b) What if $L_1 \subseteq \{a, b, c\}^*$ and
   $L = \{wcv \in \{a, b, c\}^* \mid (2|w|_a = |v|_b)\ w, v \in L_1 \cap \{a, b\}^*\}$. Discussion on L_1.

4. Prove that the following languages are not regular:
   (a) $\{c^m b^n a^n \mid n > 0, m \geq 1\}$
   (b) $\{ca^n b^{n+k+2} a^k \mid n > 0, n > k > 1\}$
   (c) $L = \{c^m a^n b^l \mid n \neq l, m > 1\}$

Marking Scheme: The marks for assignments are added together.

- 0 marks: no submission or plagiarism, or almost no correct solution.
- 1 mark: most exercises are started and some are correct.
- 2 marks: most exercises are started and the majority are correct.
- 3 marks: almost all exercises are started and almost all are correct