

Regular Expressions In Class Examples and Extra Problems

1. Give a language description based on the regular expression with $\Sigma = \{0, 1\}$.

- (a) $r_a = 0^*10^*$
- (b) $r_b = \Sigma^*1\Sigma^*$
- (c) $r_c = \Sigma^*001\Sigma^*$
- (d) $r_d = 1^*(01^+)^*$
- (e) $r_e = (\Sigma\Sigma)^*$
- (f) $r_f = (\Sigma\Sigma\Sigma)^*$
- (g) $r_g = 01 \cup 10$
- (h) $r_h = 0\Sigma^*0 \cup 1\Sigma^*1 \cup 0 \cup 1$
- (i) $r_i = (0 \cup \lambda)1^*$
- (j) $r_j = (0 \cup \lambda)(1 \cup \lambda)$
- (k) $r_k = 1^*\emptyset$
- (l) $r_l = \emptyset^*$

2. Given the regular expression, find the language.

- (a) $r_a = a^*(a \cup b)$
- (b) $r_b = (a \cup bc)^*$
- (c) $r_c = (a \cup b)^*(a \cup bb)$
- (d) $r_d = (aa)^*(bb)^*b$

3. Given a language, find a regular expression that expresses that language.

- (a) $L_a = \{w \in \Sigma^* : w \text{ has at least one pair of consecutive zeros}\} \Sigma = \{0, 1\}$
- (b) $L_b = \{w \in \Sigma^* : w \text{ has at least no pairs of consecutive zeros}\} \Sigma = \{0, 1\}$
- (c) $L_c = \{a^n b^m : n \geq 4, m \leq 3\}$
- (d) L_d are all strings containing an even number of zeros. $\Sigma = \{0, 1\}$
- (e) $L_e = \{w : |w| \bmod 3 = 0\} \Sigma = \{a, b, c\}$
- (f) $L_f = \{v w v : v, w \in \{a, b\}^*, |v| = 2\}$

- (g) L_g are all strings that contain at least one occurrence of each symbol in Σ .
 $\Sigma = \{a, b\}$
- (h) L_h are all bit strings whose value, when interpreted as a binary integer, is ≥ 40 .
4. Given a regular expression, find an NFA that accepts $L(r)$.
- (a) $r = (b^*ab \cup \lambda)(ab \cup b)^*$
- (b) $r = (a^* \cup bb)^*(ba^* \cup \lambda)$
- (c) $r = (a \cup b)^*b(a \cup bb)^*$
5. Given a regular expression, find a DFA that accepts $L(r)$.
 $r = aa^* \cup aba^*b^*$
6. Convert the following DFA into a regular expression using the procedure learned in class.

