

# CSI 409: DFA design problems

## Some answers and hints

1. Disprove the following:  $A \circ (B \cap C) = (A \circ B) \cap (A \circ C)$  for all languages  $A, B, C$ .

Take  $A = \{\epsilon, a\}$ ,  $B = \{\epsilon\}$ ,  $C = \{a\}$ .

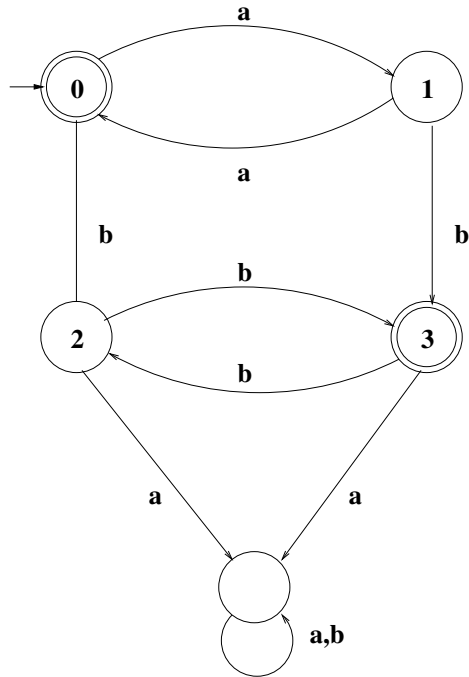
2. Disprove the following: for all languages  $A, B$

$$A \subsetneq B \rightarrow A^* \subsetneq B^*$$

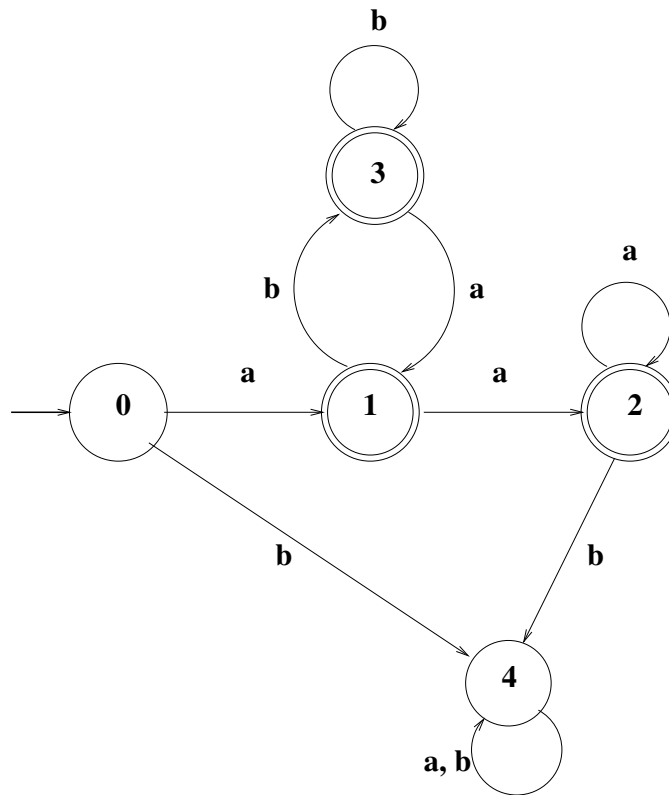
Take  $A = \{a\}$  and  $B = \{\epsilon, a\}$ .

3. Construct deterministic finite automata (DFAs) recognizing the following languages over the alphabet  $\{a, b\}$ :

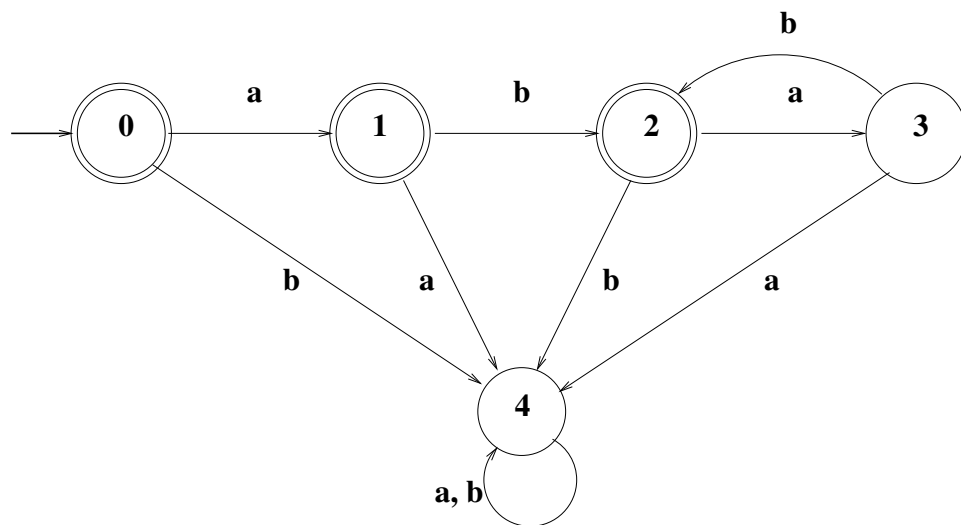
(a)  $\{a^i b^j \mid i \geq 0, j \geq 0, i + j \text{ is an even number}\}$



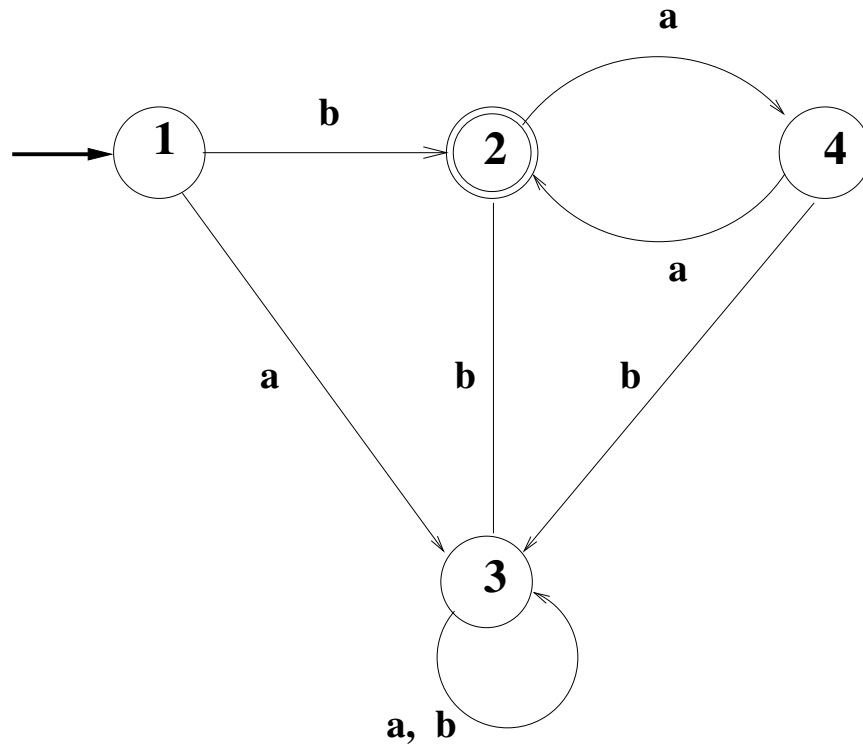
(b) The set of all strings that begin with  $a$  but do not contain  $aab$  as a substring.



(c)  $(ab)^* \cup a$



(d)  $b(aa)^*$



4. Consider the language  $a^*b \cup b^*$  over the alphabet  $\{a, b\}$ . Show that any DFA that accepts this language has to contain a **dead state**.

No string that has  $ba$  as a prefix is in the language.