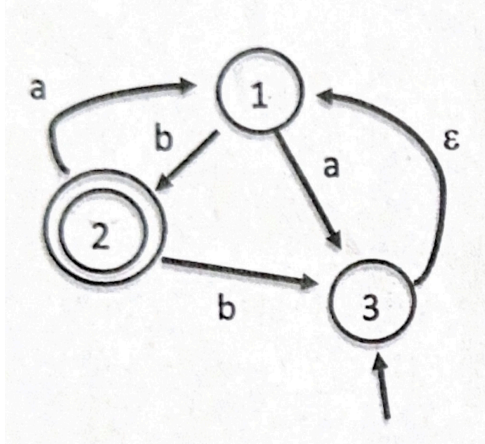


CS312 Exam 1 (Part B)

16. Complete the 8-state diagram of the equivalent DFA to the following NFA and cross out the five states that would not appear in the (reduced) final 3-state DFA. **Be sure to indicate all accept and start states. You should redraw the final reduced DFA in the box provided. Note:** ϵ is the epsilon character. (14 points)



(over)

CS312 Exam 1 (Part B)

17. Construct a 7-state diagram (graph) for the DFA that will recognize the regular language $L = \{w \mid w \text{ has **at most** two a's and **at least** one b}\}$ assuming $\Sigma = \{a, b\}$. (6 points)

18. Construct a 4-state diagram (graph) for the DFA that will recognize the regular language $M = \{w \mid w \text{ does **not** contain the substring 110}\}$ assuming $\Sigma = \{0, 1\}$. (10 points)

19. Provide a derivation (not parse tree) for the string $(\mathbf{a+b})+\mathbf{b}$ that can be generated by the CFG $N = (\{S, A, B\}, \{a, b, (, +, \epsilon\}, R, S)$, where R is given below:

$S \rightarrow A B$

$A \rightarrow (A) \mid B \mid a$

$B \rightarrow A + B \mid b \mid \epsilon$

As an example, the derivation of the string $\mathbf{a a + b}$ can be written as:

$S \rightarrow A \underline{B} \rightarrow \underline{A} A + B \rightarrow a \underline{A} + B \rightarrow a a + \underline{B} \rightarrow a a + b$

Note: You must underline each nonterminal that is replaced in each step. Only replace **one nonterminal** per step (as shown above). (8 points)