Theory of Computation (CSC 339) – Fall 2023
Instructor: Prof. M.B. Menai
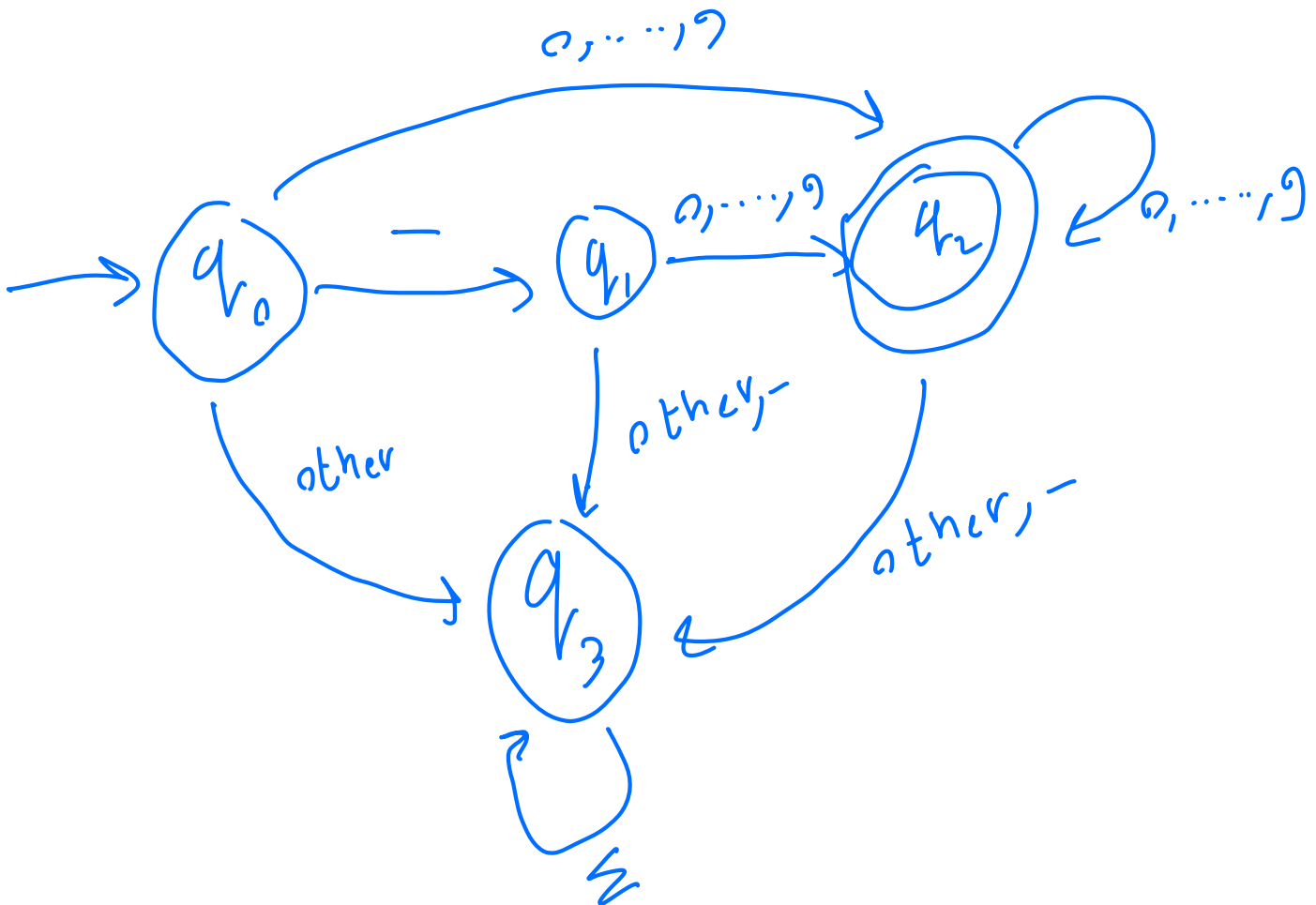
Tutorial 1 (Deterministic Finite Automata)

1. Consider the problem of determining if a string is an integer in the following format: an optional minus sign followed by at least one digit. Design a DFA for this problem.

2. Consider the problem of determining if a string is a number in the following format: an optional minus sign followed by at least one digit, or an optional minus sign followed by any number of digits, a decimal point and at least one digit. Design a DFA for this problem.

3. Give state diagrams of DFAs recognizing the following languages. In all parts, the alphabet is $\Sigma = \{0, 1\}$.

   (a) $\{w | w$ begins with 1 and ends with 0$\}$.

   (b) $\{w | w$ contains the substring 0101$\}$.

   (c) $\{w | w$ does not contain the substring 0101$\}$.

   (d) $\{w | w$ contains a number of 1's that is a multiple of 3$\}$.

4. Each of the following languages is the intersection of two simpler languages. In each part, construct DFAs for the simpler languages, then combine them by construction to give the state diagram for the language given. In all parts, the alphabet is $\Sigma = \{a, b\}$.

   (a) $\{w | w$ has at least three a's and at least two b's$\}$.

   (b) $\{w | w$ has an even number of a's and one or two b's$\}$.

   (c) $\{w | w$ starts with an a and has at most one b$\}$.

   (d) $\{w | w$ has an odd number of a's and ends with a b$\}$.

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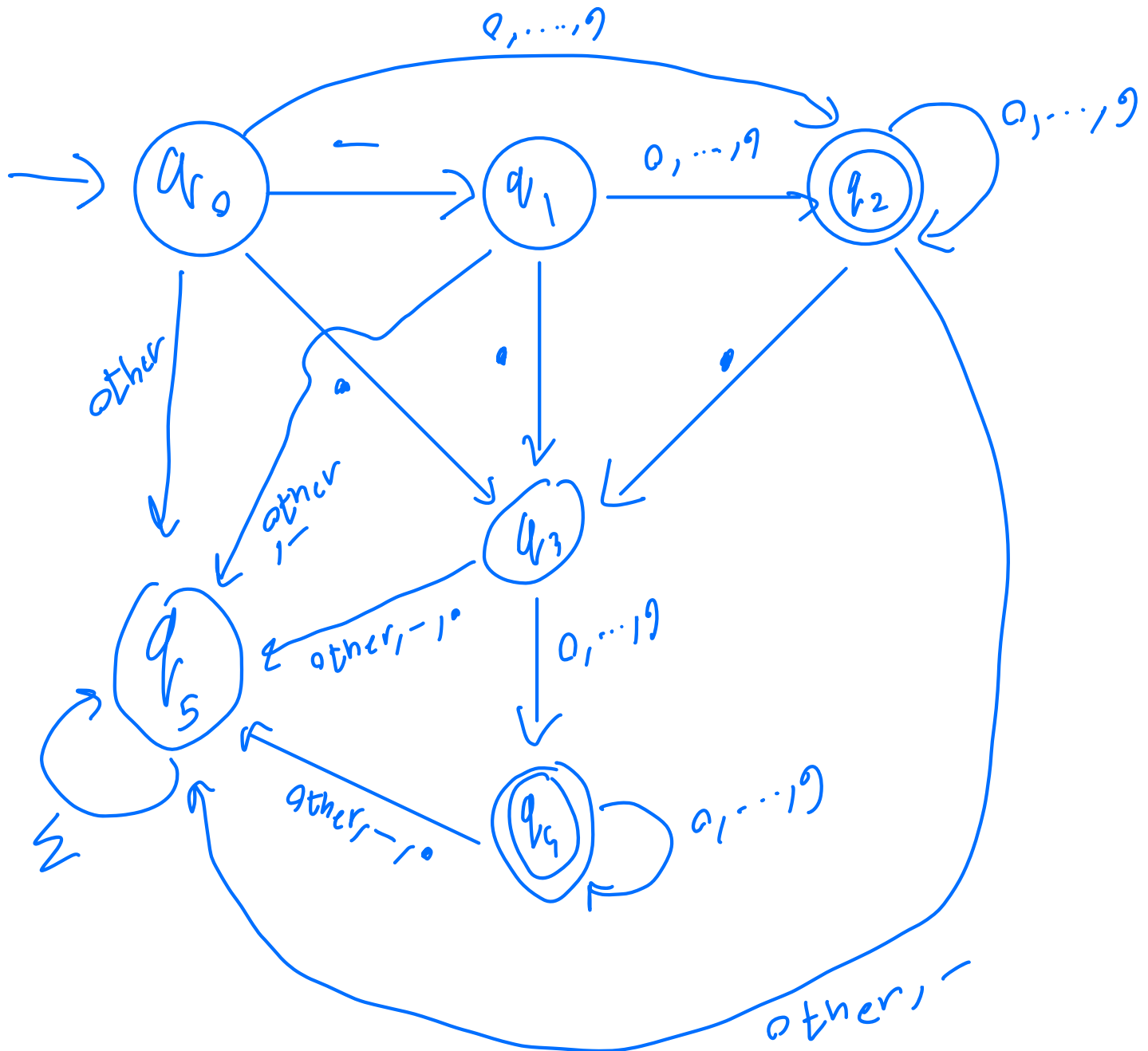
1) $\Sigma = \{0, \dots, 9, -, \underbrace{a, \dots, z, !, \$, \dots}_{\text{other}}\}$

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