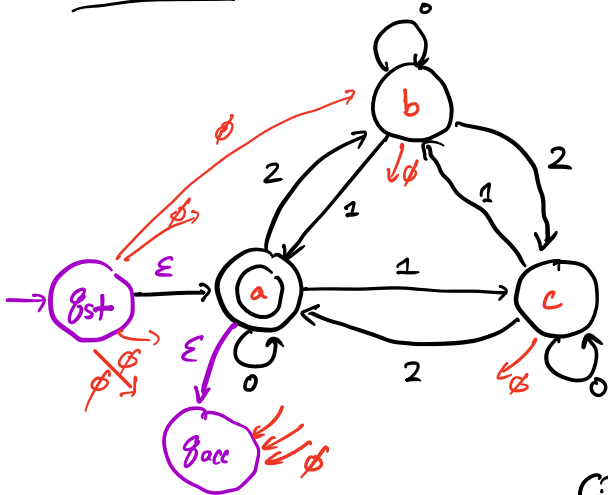


Sipser p. 70 - GNFA (formal def. p. 73)
 p. 71 - DFA → GNFA
 pp. 72-74 - GNFA → Regex.

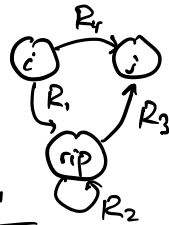


DFA: chars sum to $O(n^3)$?

1. DFA → GNFA.

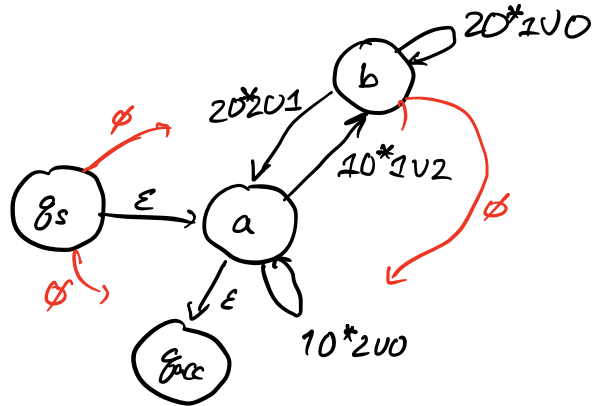
- start state w/ no incoming edges
- end state w/ no outgoing edges
- edges between every other state pair

2. Rip out state c.

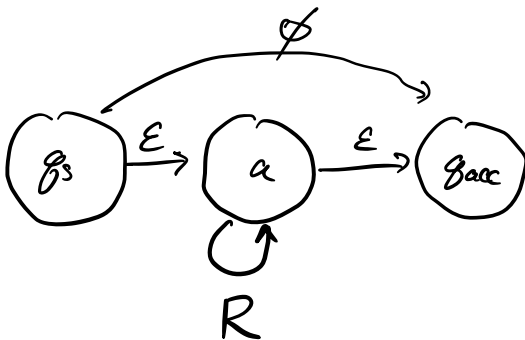


→ (i,j) with $(R_1 R_2^* R_3) \cup R_4$

| state pair | $(R_1 R_2^* R_3) \cup R_4$ |
|----------------------|---|
| q_{start}, a | $(\emptyset \cup \emptyset^* 2) \cup \epsilon = \epsilon$ |
| q_{start}, b | $\emptyset \cup \emptyset = \emptyset$ |
| q_{start}, q_{acc} | $\emptyset \cup \emptyset = \emptyset$ |
| a, a | $1 \cup 0^* 2 \cup 0$ |
| a, b | $1 \cup 0^* 1 \cup 2$ |
| a, q_{acc} | $\emptyset \cup \epsilon = \epsilon$ |
| b, b | $2 \cup 0^* 1 \cup 0$ |
| b, a | $2 \cup 0^* 2 \cup 1$ |
| b, q_{acc} | $\emptyset \cup \emptyset = \emptyset$ |



3. Rip out state b



| | |
|---|---|
| q_{start}, q_{acc} | $\emptyset \cup \emptyset = \emptyset$ |
| q_{start}, a | $\emptyset \cup \epsilon = \epsilon$ |
| a, q_{acc} | $\emptyset \cup \epsilon = \epsilon$ |
| a, a | $((1 \cup 0^* 1) \cup 2) ((2 \cup 0^* 2) \cup 0)^*$ |
| $R = ((2 \cup 0^* 2) \cup 1) \cup ((1 \cup 0^* 1) \cup 2) \cup 0$ | |

4. Rip out state a.

$$(E)(R)^*(E) \cup \emptyset = R^*$$

$$\overbrace{((10^*1) \cup 2)(120^*1) \cup 0)^* ((20^*2) \cup 1) \cup ((10^*2) \cup 0)^*}$$

\uparrow
equivalent to my original DFA