Definition of GNFA I

- Between any two states: a regular expression
- $(Q, \Sigma, \delta, q_{start}, q_{accept})$

$$\delta : (Q - \{q_{accept}\}) \times (Q - \{q_{start}\}) \rightarrow R$$

  R: all regular expressions over Σ

- DFA $\rightarrow$ GNFA

  Two new states: q_{start}, q_{accept}

$$q_{start} \rightarrow q_0 \text{ with } \epsilon$$
$$\text{any } q \in F \rightarrow q_{accept} \text{ with } \epsilon$$

Definition of GNFA II

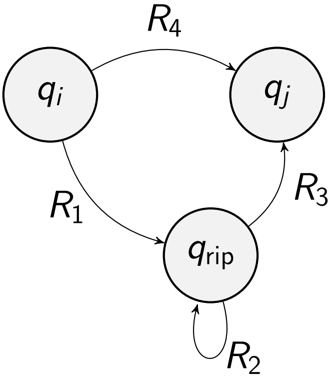
- In the definition, between any two states there is an expression

  But what if in the graph two states are not connected ?

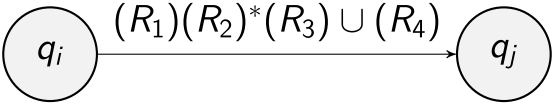
  $\emptyset \in R$ so if no connection, we simply consider $\emptyset$ as the expression between two states

GNFA $\rightarrow$ regular expression I

- Fig 1.63



GNFA $\rightarrow$ regular expression II



- q_{rip} is the state being removed
- In the procedure
  3-state DFA $\rightarrow$ 5-state GNFA $\rightarrow$ 4-state $\cdots \rightarrow$
  2-state GNFA $\rightarrow$ regular expression
- In the procedure any any (i, j) related to q_{rip} considered
- Algorithm: convert(G)
  1. k: # of G

GNFA $\rightarrow$ regular expression III

2. If $k = 2$
$$\text{return } R$$
3. If $k > 2$, choose any $q_{\text{rip}} \in Q \backslash \{q_s, q_a\}$ for removal
$$Q' = Q - \{q_{\text{rip}}\}$$
$$\forall q_i \in Q' - \{q_{accept}\}, q_j \in Q' - \{q_{start}\}$$
$$\delta'(q_i, q_j) = R_1 R_2^* R_3 \cup R_4,$$
where
$$R_1 = \delta(q_i, q_{\text{rip}}), R_2 = \delta(q_{\text{rip}}, q_{\text{rip}}),$$
$$R_3 = \delta(q_{\text{rip}}, q_j), R_4 = \delta(q_i, q_j)$$

GNFA $\rightarrow$ regular expression IV

4. Run convert(G'), where

$$G' = (Q', \Sigma, \delta', q_s, q_a)$$

- Why in the textbook we modify DFA to GNFA?
  Is it ok to use NFA?
  Seems ok??