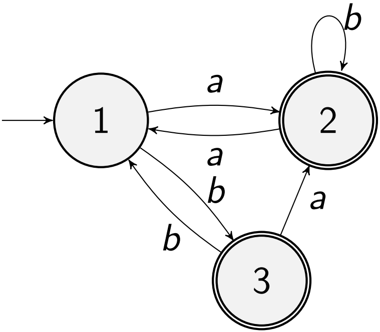
Regular $\Rightarrow$ a regular expression I

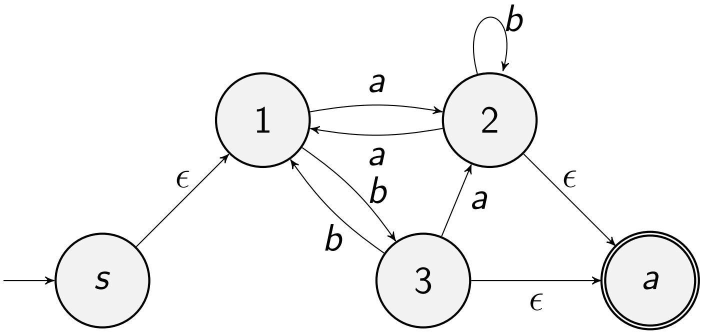
- Example 1.68

  Consider the following DFA



Regular $\Rightarrow$ a regular expression II

- It is not that easy to directly see what the regular expression is
- We need a procedure shown below
- First, add a start and an accept states



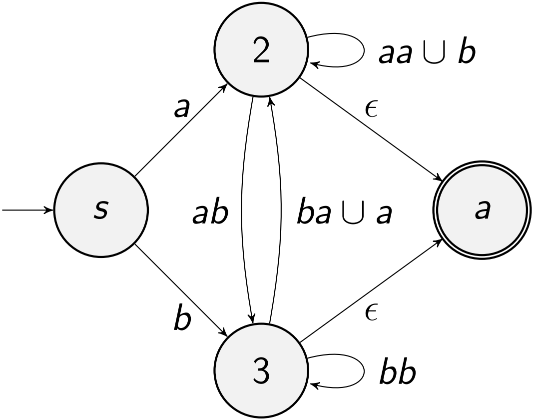
Regular $\Rightarrow$ a regular expression III

- This generates a generalized NFA (GNFA)
- Our procedure is

$$\text{DFA} \rightarrow \text{GNFA} \rightarrow \text{regular expression}$$

- Remove state 1

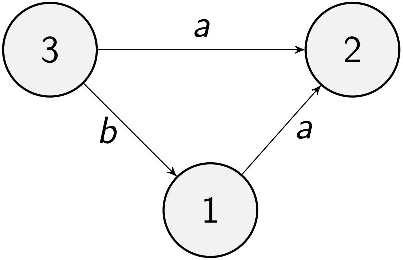
Regular $\Rightarrow$ a regular expression IV



- Example: the link

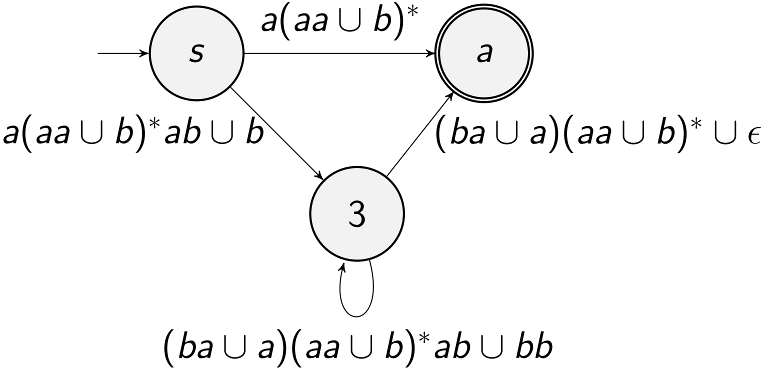
$$3 \to 2$$

Regular $\Rightarrow$ a regular expression V



- Thus $ba \cup a$
- Idea: now 1 is removed. Need to check how we can go from 3 to 2 via state 1
- Need to check all pairs of states
- Remove state 2

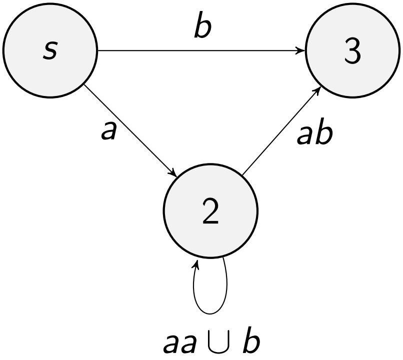
Regular $\Rightarrow$ a regular expression VI



- Example:

$$s \to 3$$

Regular $\Rightarrow$ a regular expression VII



- Thus $a(aa \cup b)^* ab \cup b$

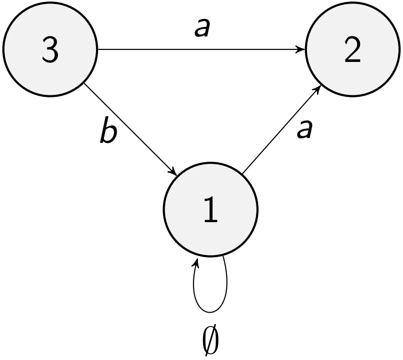
Regular $\Rightarrow$ a regular expression VIII

- Here we need to handle

$$2 \xrightarrow{aa \cup b} 2$$

- Thus in the early example of removing state 1, we actually have

Regular $\Rightarrow$ a regular expression IX

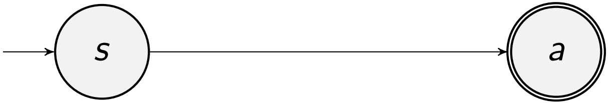


and

$$b\emptyset^* a \cup a = b\epsilon a \cup a = ba \cup a$$

- Remove state 3

Regular $\Rightarrow$ a regular expression X



$$(a(aa \cup b)^*ab \cup b)((ba \cup a)(aa \cup b)^*ab \cup bb)^*$$
$$((ba \cup a)(aa \cup b)^* \cup \epsilon) \cup a(aa \cup b)^*$$

- We will formally explain the procedure