Example 1.68
Consider the following DFA
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.
This generates a generalized NFA (GNFA)

Our procedure is

DFA $\rightarrow$ GNFA $\rightarrow$ regular expression

Remove state 1
Example: the link

3 \rightarrow 2
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

$$s \Rightarrow a(a a \cup b)^*$$

$$s \Rightarrow a(a a \cup b)^*ab \cup b$$

$$s \Rightarrow (b a \cup a)(a a \cup b)^* \cup \epsilon$$

$$s \Rightarrow 3$$

Example:

$$s \rightarrow 3$$
Thus \( a(aa \cup b)^* ab \cup b \)
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 $\mathcal{L}$

and

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

- Remove state 3
Regular $\Rightarrow$ a regular expression $X$

We will formally explain the procedure

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

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