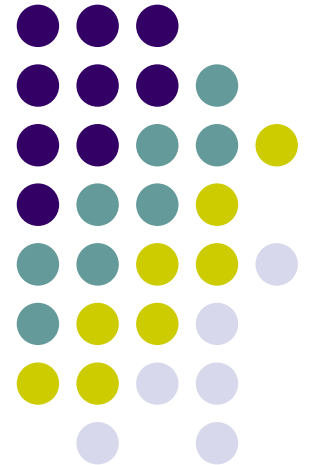# From Regular Expression to NFA
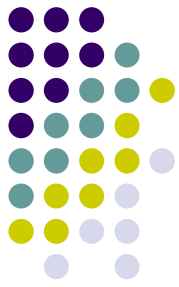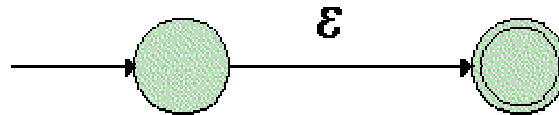
Thompson's Construction

Thompson's Construction

- **Thompson's construction** is a technique for constructing a NFA from a regular expression.

- There are a few simple rules that can be combined to produce a NFA from any arbitrary regular expression.
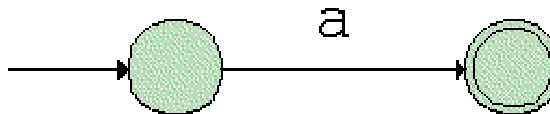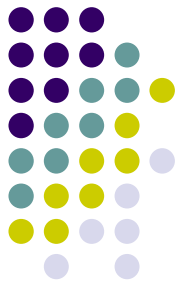
Thompson's Construction

- For ε, construct the NFA:

- For **a**, construct the NFA:

Thompson's Construction

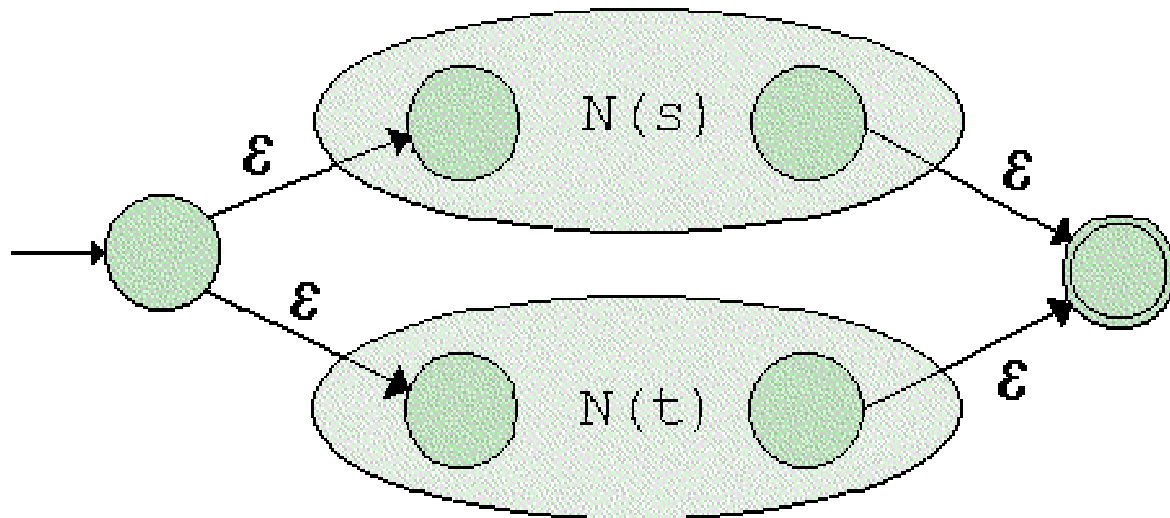- Suppose N(s) and N(t) are NFAs for regular expressions **s** and **t**, respectively. For the regular expression **s | t**, construct the NFA:

Thompson's Construction
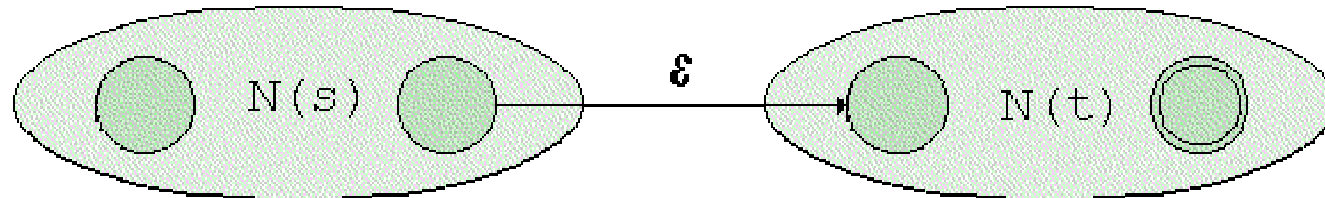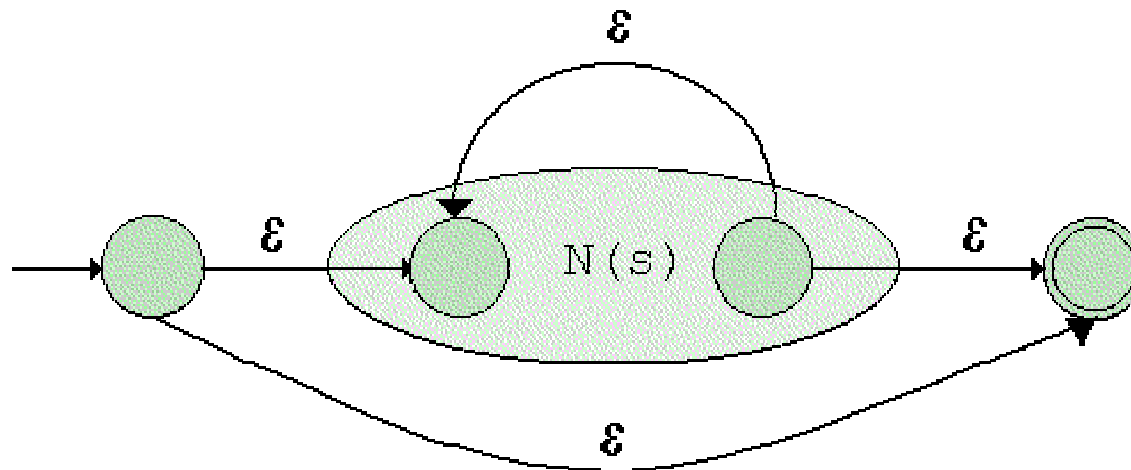
- Suppose N(s) and N(t) are NFAs for regular expressions s and t, respectively. For the regular expression st, construct the NFA:
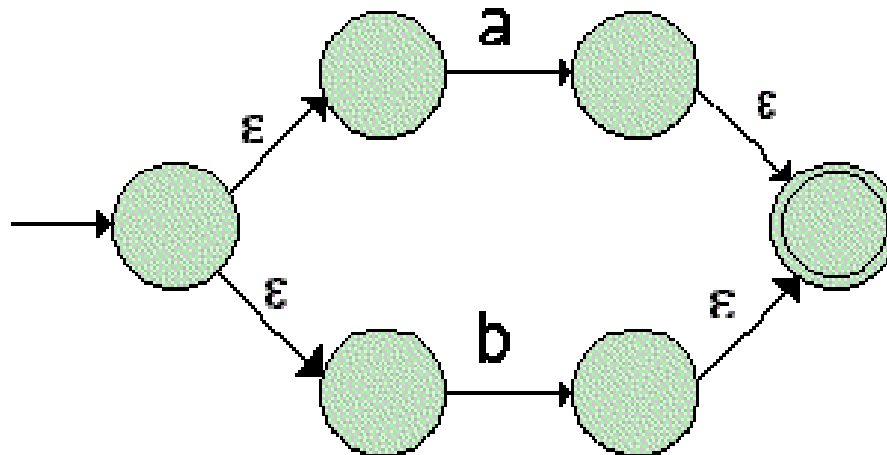
Thompson's Construction

- Suppose N(s) is the NFA for regular expression **s**. For the regular expression **s***, construct the NFA:
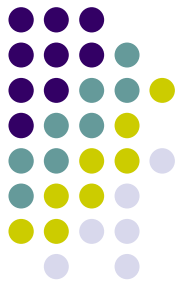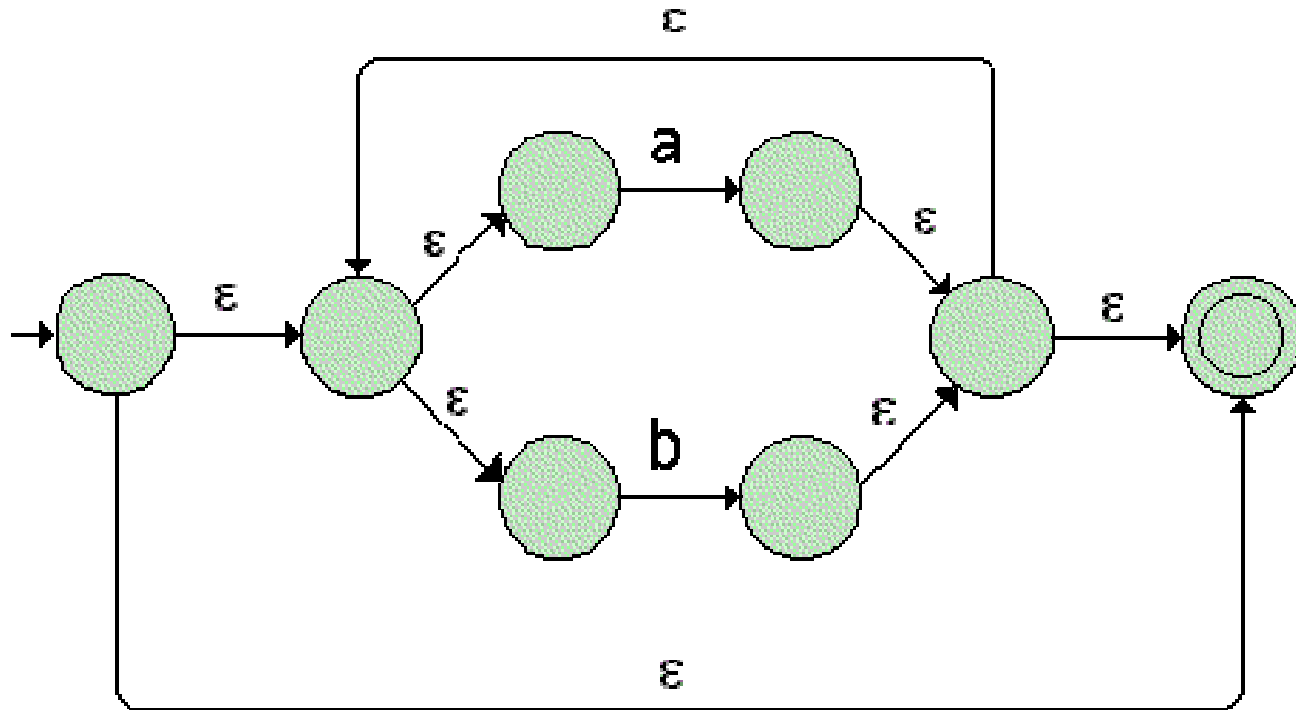
An example

- To demonstrate, let's find an NFA for the regular expression **(a|b)*aa**.
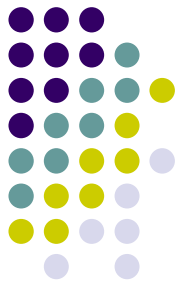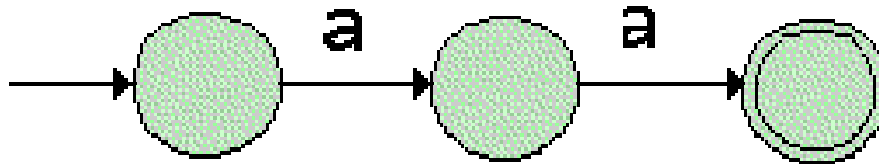- First, the NFA for **a|b** is

Example, continued

- Now, we draw the NFA for **(a|b)***:
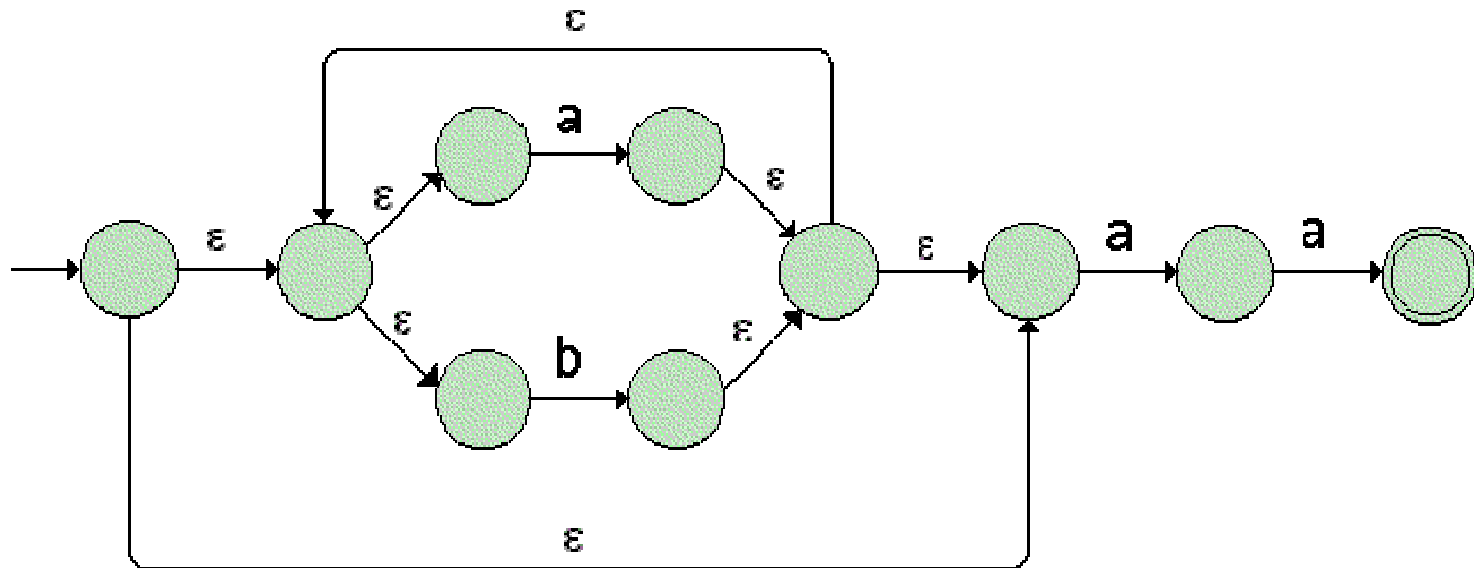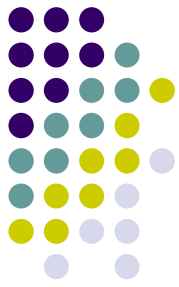
Example, continued

- The NFA for **aa**:

End of example

- Putting this all together, we get the NFA for **(a|b)*aa**:

What now?

- We know how to produce an NFA that recognizes a string represented by a regular expression.

- Problem: it is difficult to write a program to implement an NFA

- Solution: transform the NFA into a DFA that recognizes the same language

- Next step: From NFA to DFA