4.3 Closure Properties of NFAs
Closure properties of NFAs

Are the class of languages accepted by NFAs closed under the following operations?

- union
- intersection
- concatenation
- Kleene star
- complement
Closure under union

**Theorem**

For any two NFAs $N_1$ and $N_2$ there is a NFA $N$ such that $L(N) = L(N_1) \cup L(N_2)$. 
Closure under union

**Theorem**

For any two NFAs $N_1$ and $N_2$ there is a NFA $N$ such that $L(N) = L(N_1) \cup L(N_2)$. 

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q_1 \quad N_1 \quad f_1
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q_2 \quad N_2 \quad f_2
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Closure under concatenation

**Theorem**

For any two NFAs $N_1$ and $N_2$ there is a NFA $N$ such that $L(N) = L(N_1) \cdot L(N_2)$. 

![Diagram showing closure under concatenation](image)
Theorem

For any two \textbf{NFA}s $N_1$ and $N_2$ there is a \textbf{NFA} $N$ such that $L(N) = L(N_1) \cdot L(N_2)$. 
Closure under Kleene star

Theorem

For any \( \text{NFA } N_1 \) there is a \( \text{NFA } N \) such that \( L(N) = (L(N_1))^* \).
Closure under Kleene star

**Theorem**

For any NFA $N_1$ there is a NFA $N$ such that $L(N) = (L(N_1))^*$.

Does not work! Why?
Closure under Kleene star

**Theorem**

*For any NFA $N_1$ there is a NFA $N$ such that $L(N) = (L(N_1))^*$.***

Does not work! Why?
Closure under Kleene star

**Theorem**

For any NFA $N_1$ there is a NFA $N$ such that $L(N) = (L(N_1))^*$. 
THE END

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(for now)