Regular Expressions to Automata

Lecture 5
Section 3.7

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State Diagrams

An Example

Assignment
A regular expression consists of symbols $a, b, c, \ldots$; operators $|$, $\ast$, and concatenation; parentheses $()$; and $\varepsilon$.

We can also use the extended symbols $?$ and $+$.

We describe a recursive method of building a transition diagram (NFA) from a regular expression.
Building State Diagrams

The regular expression $\varepsilon$
The regular expression $a$
The regular expression $r \mid s$
The regular expression $r \mid s$
The regular expression \( rs \)
The regular expression $rs$
The regular expression $r^*$
The regular expression $r^*$
Building State Diagrams

- Applying these rules builds an NFA representing the regular expression.
- Note that each diagram has unique start and accepting states.
- This facilitates joining them together without any complications.
Example (Building a State Diagram)

- Build a state diagram from the regular expression

\[ b^* (ab^*a)^* b^* \].
Create $b$
Form the Kleene closure $b^*$
Create two copies of a
Concatenate $a$, $b^*$, and $a$
Form the Kleene closure \((ab^*a)^*\)
Create two copies of b
Form the Kleene closures $b^*$
Concatenate $b^*$, $(ab^*a)^*$, and $b^*$
The regular expression $b^*(ab^*a)^*b^*$
The states relabeled
Building State Diagrams

The DFA
Relabel the states
Eliminate the unnecessary states \( \{1, 3\}, \{2, 5\} \)
Arrange in a simpler form
Outline

1. State Diagrams
2. An Example
3. Assignment
Assignment

- Read Section 3.7.
- p. 166: 3.