

# Finite Automata

What Are They?

Who Needs 'em?

An Example: Scoring in Tennis

# What is a Finite Automaton?

- ◆ A formal system.
- ◆ Remembers only a finite amount of information.
- ◆ Information represented by its *state*.
- ◆ State changes in response to *inputs*.
- ◆ Rules that tell how the state changes in response to inputs are called *transitions*.

# Why Study Finite Automata?

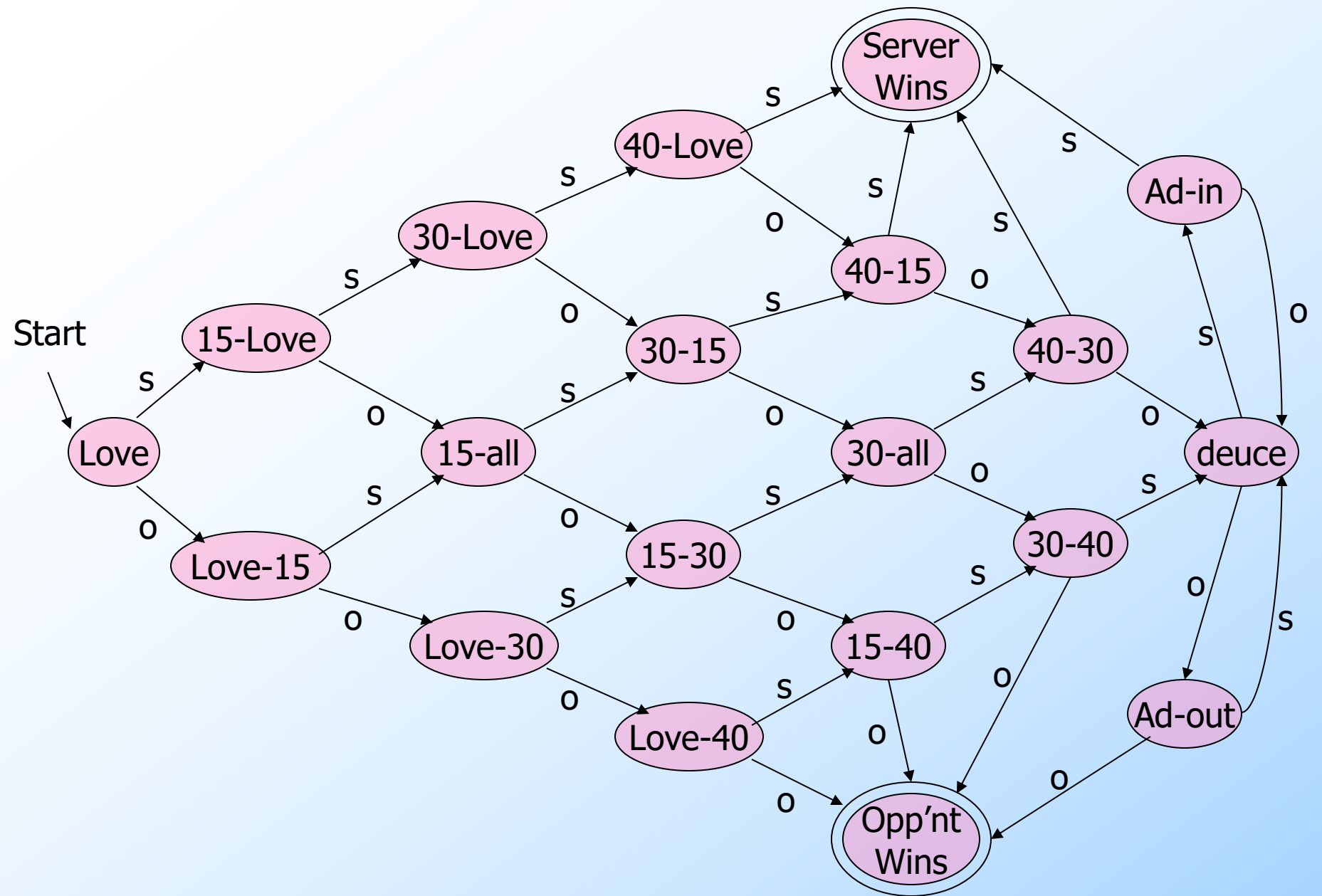
- ◆ Used for both design and verification of circuits and communication protocols.
- ◆ Used for many text-processing applications.
- ◆ An important component of compilers.
- ◆ Describes simple patterns of events, etc.

# Tennis

- ◆ Like ping-pong, except you are very tiny and stand on the table.
- ◆ *Match* = 3-5 sets.
- ◆ *Set* = 6 or more games.

# Scoring a Game

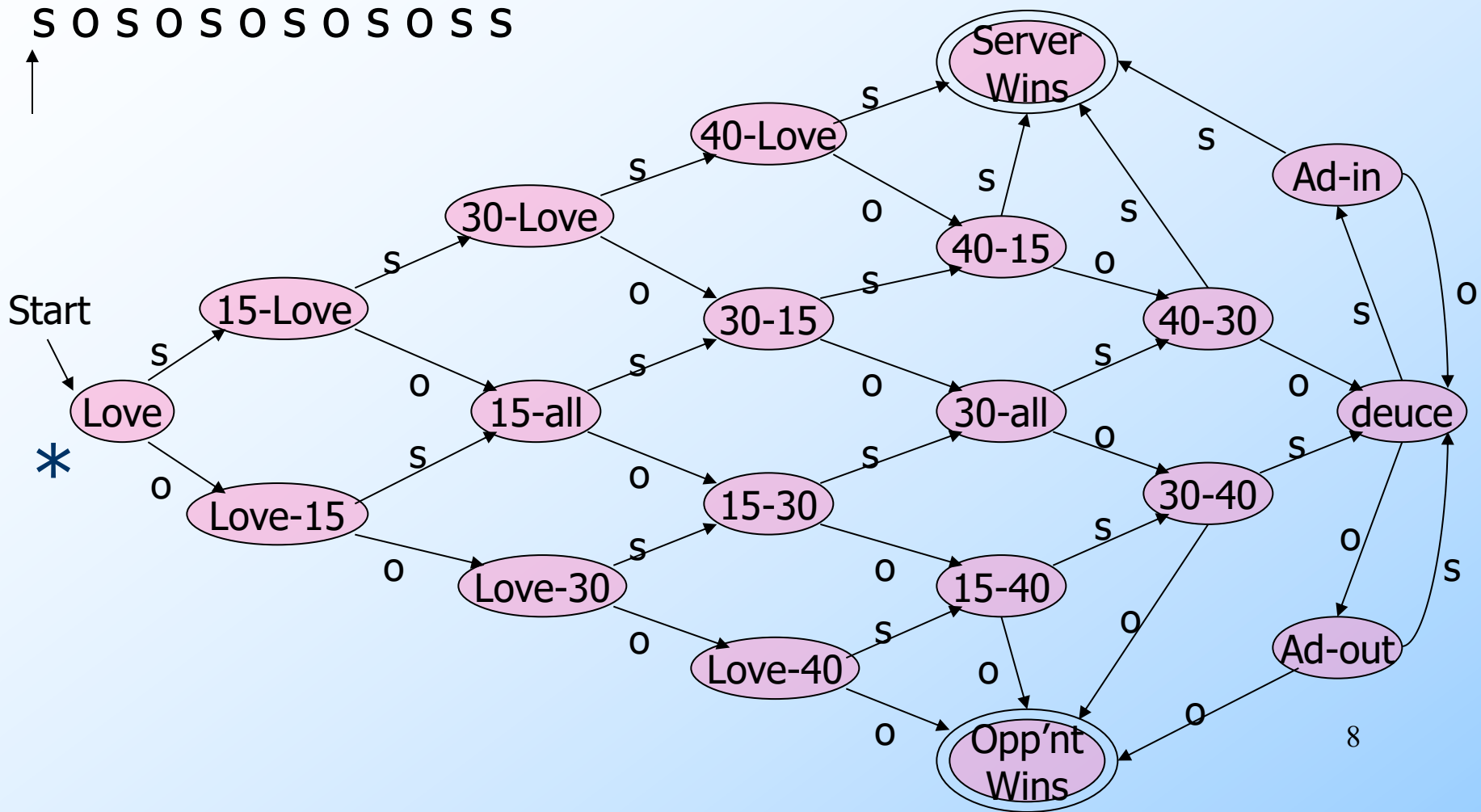
- ◆ One person serves throughout.
- ◆ To win, you must score at least 4 points.
- ◆ You also must win by at least 2 points.
- ◆ Inputs are  $s$  = "server wins point" and  $o$  = "opponent wins point."



# Acceptance of Inputs

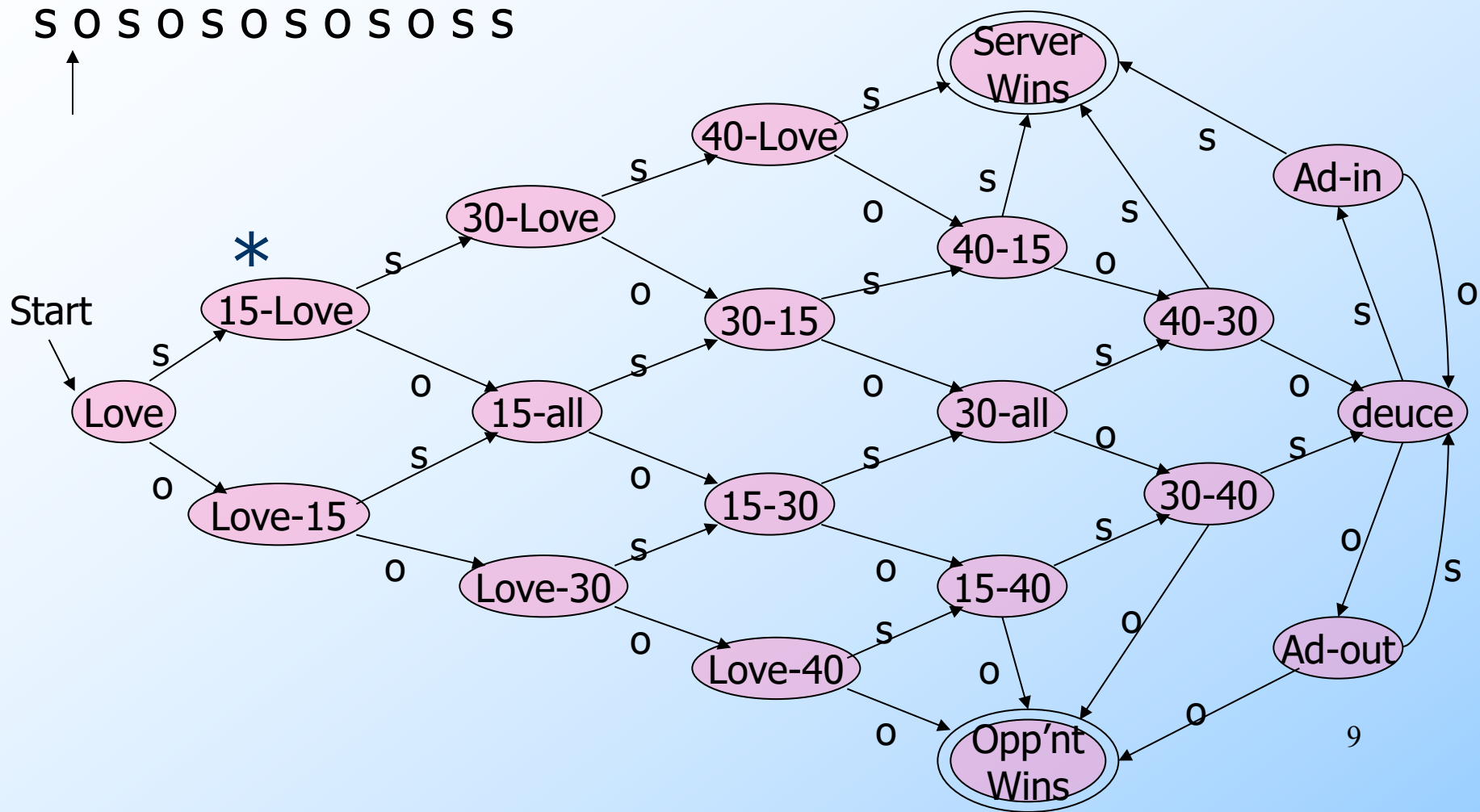
- ◆ Given a sequence of inputs (*input string*), start in the start state and follow the transition from each symbol in turn.
- ◆ Input is *accepted* if you wind up in a final (accepting) state after all inputs have been read.

## Example: Processing a String

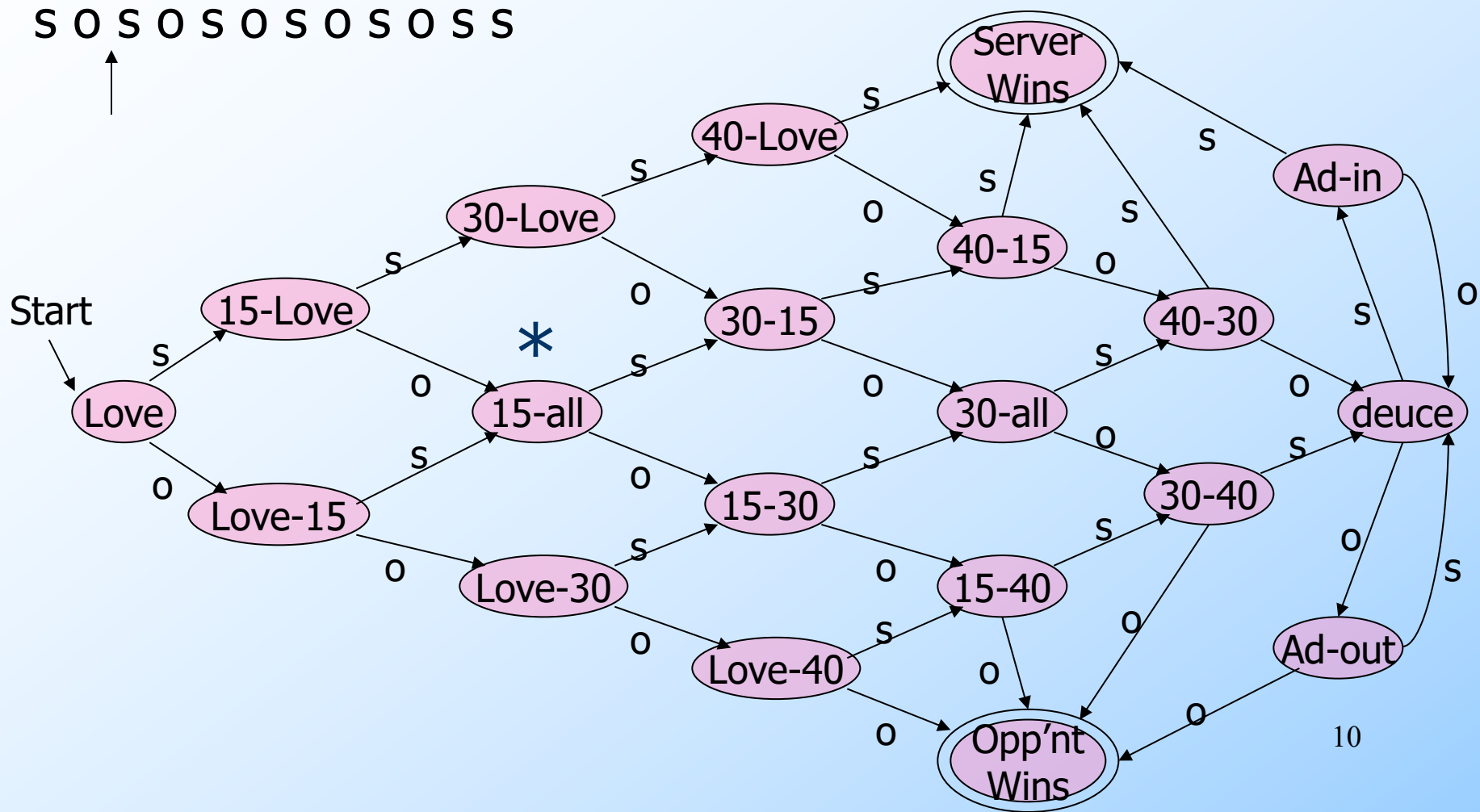




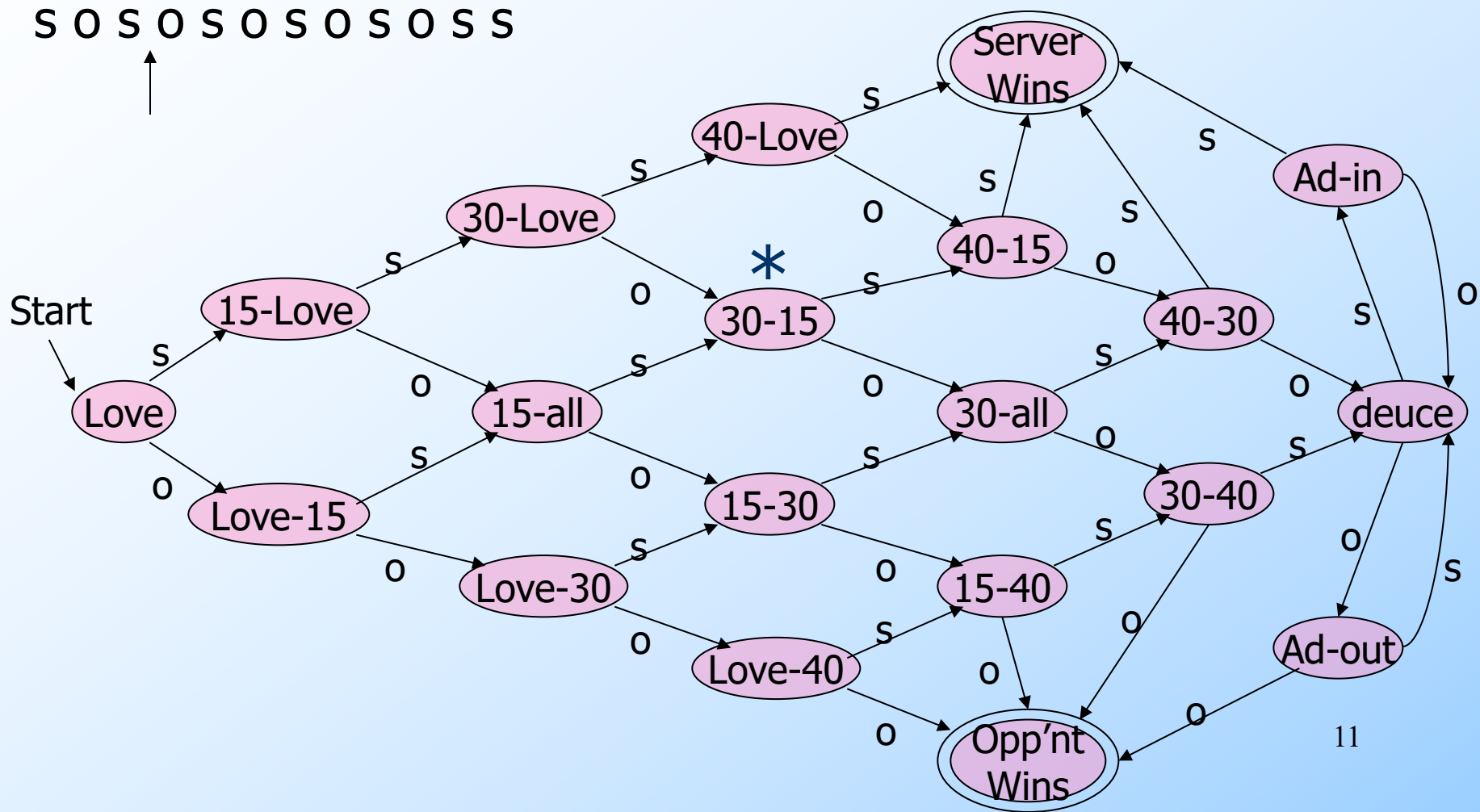
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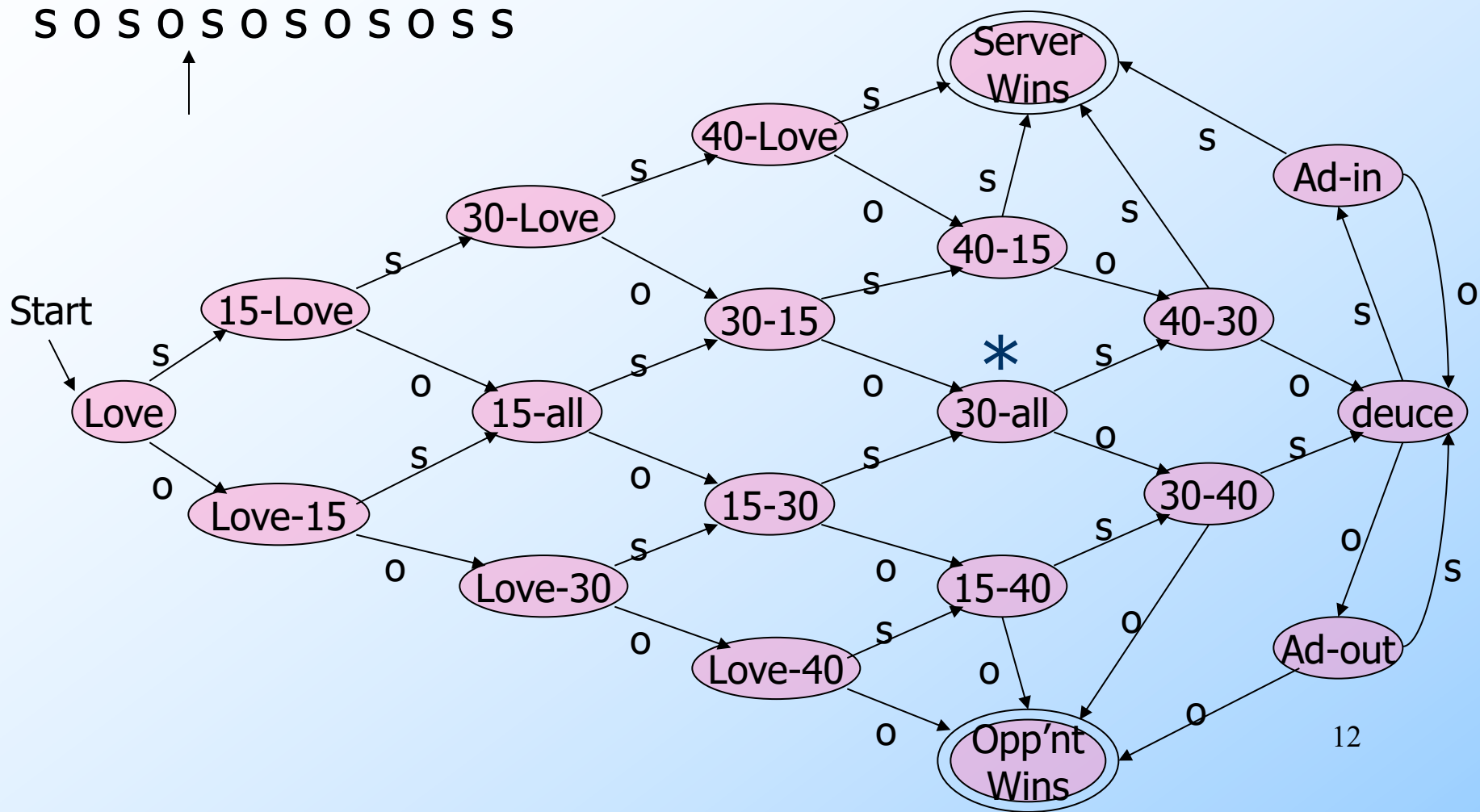
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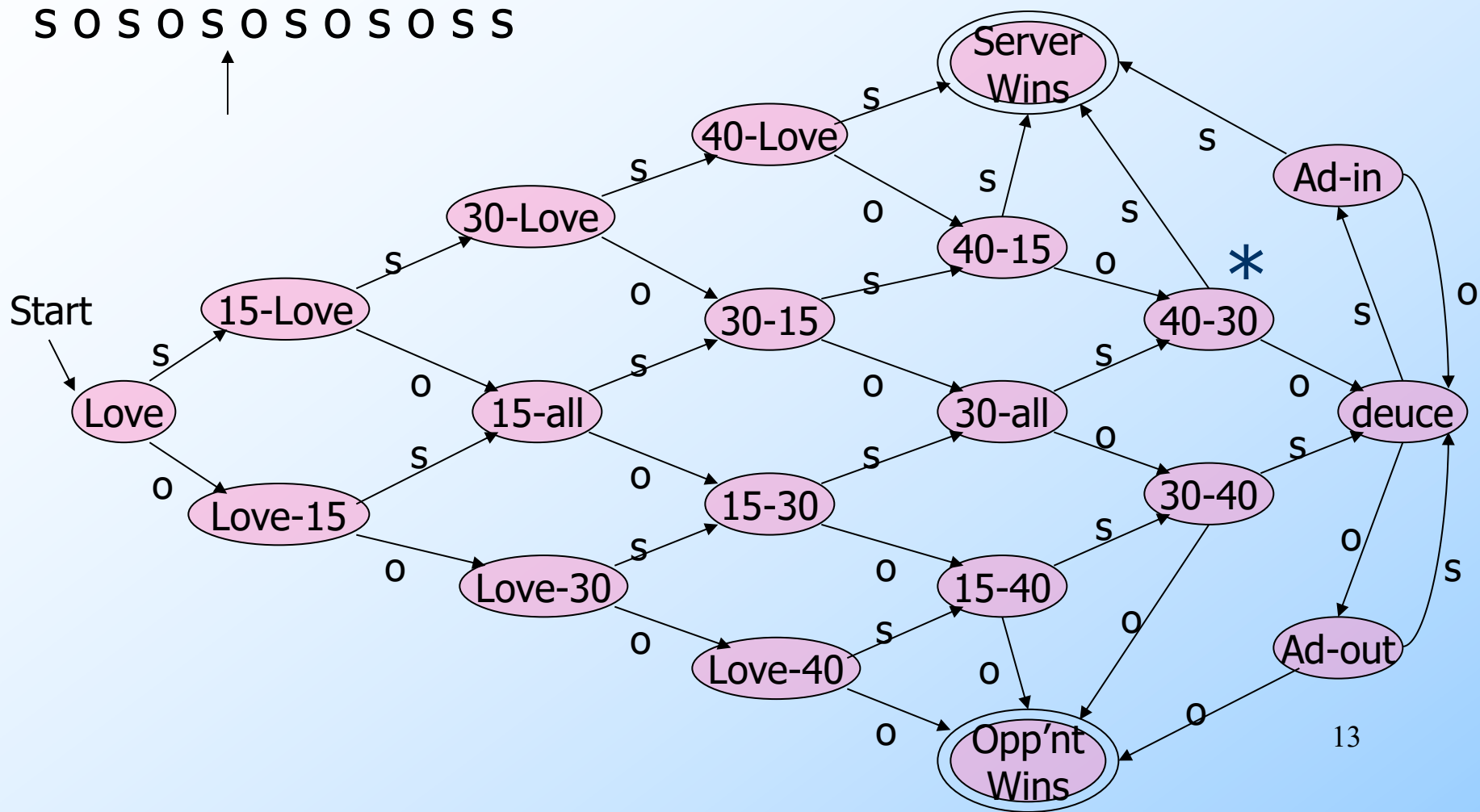
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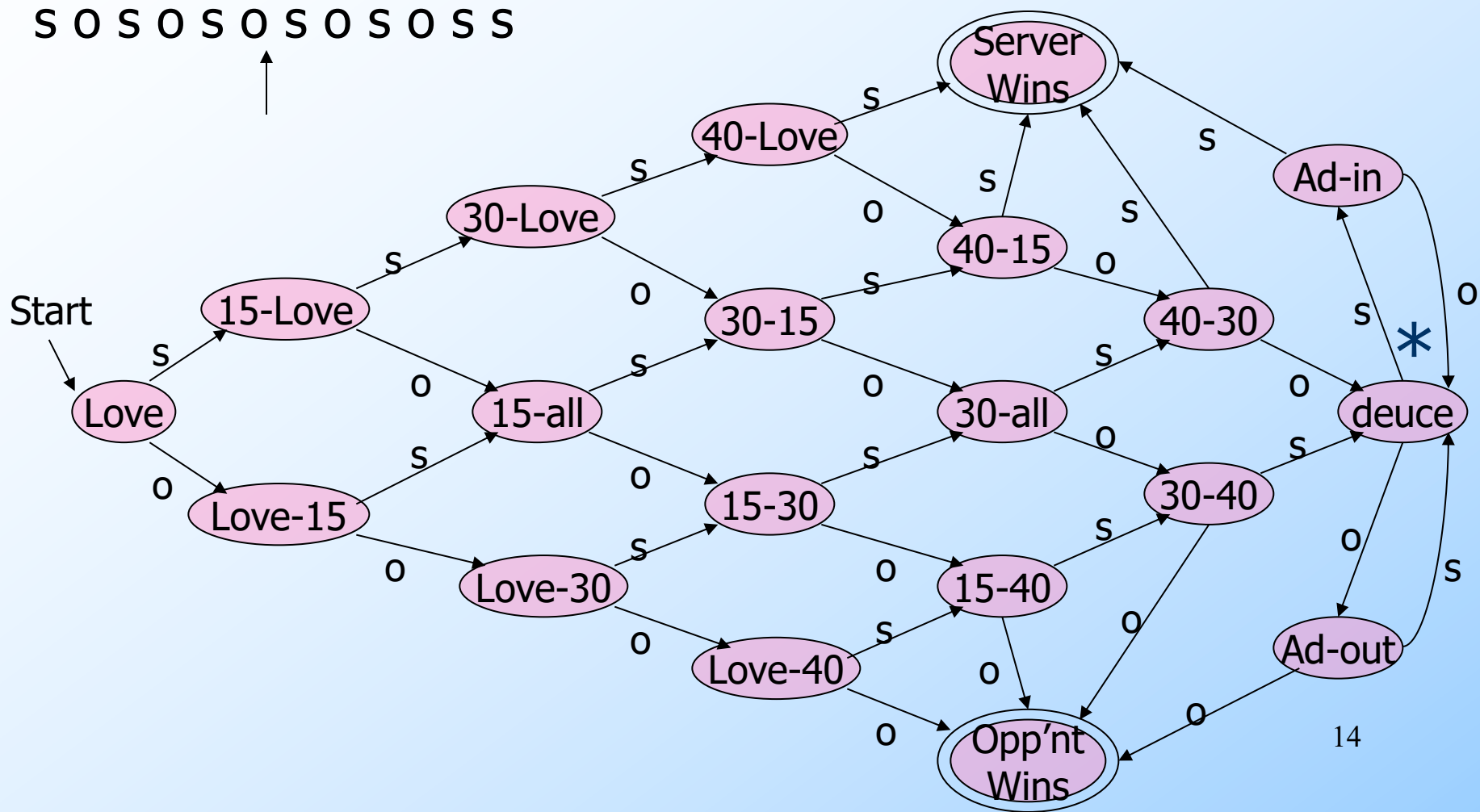
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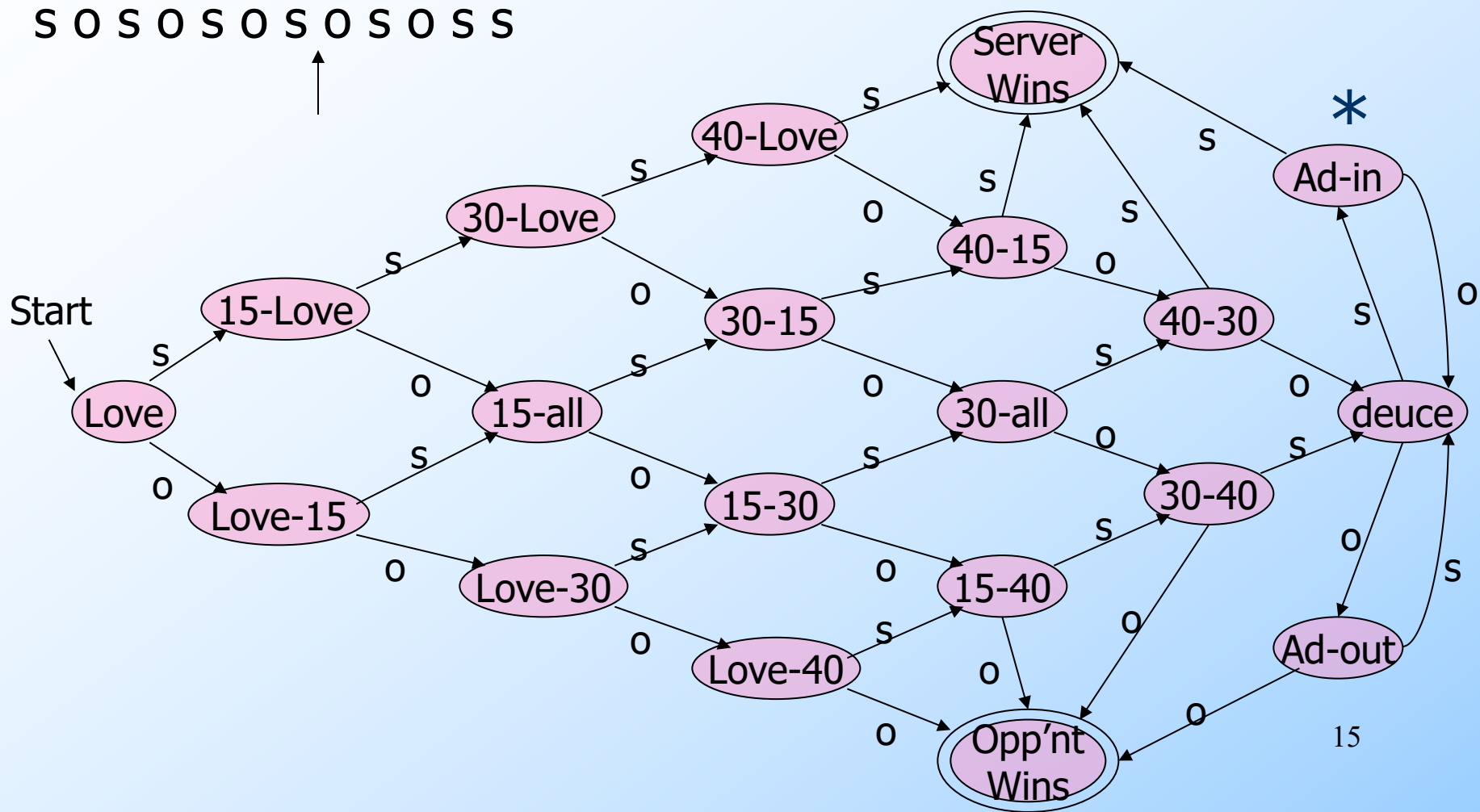
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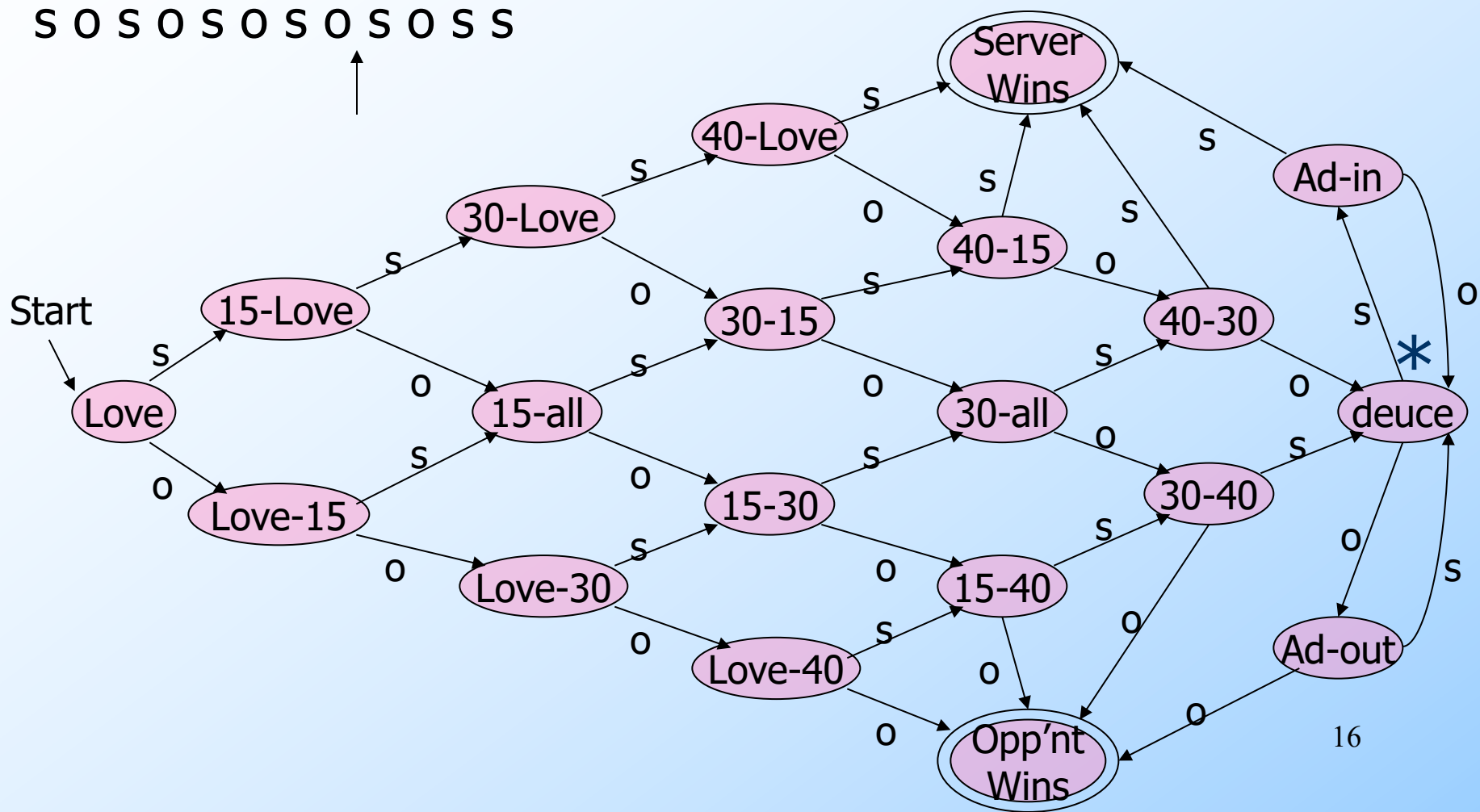


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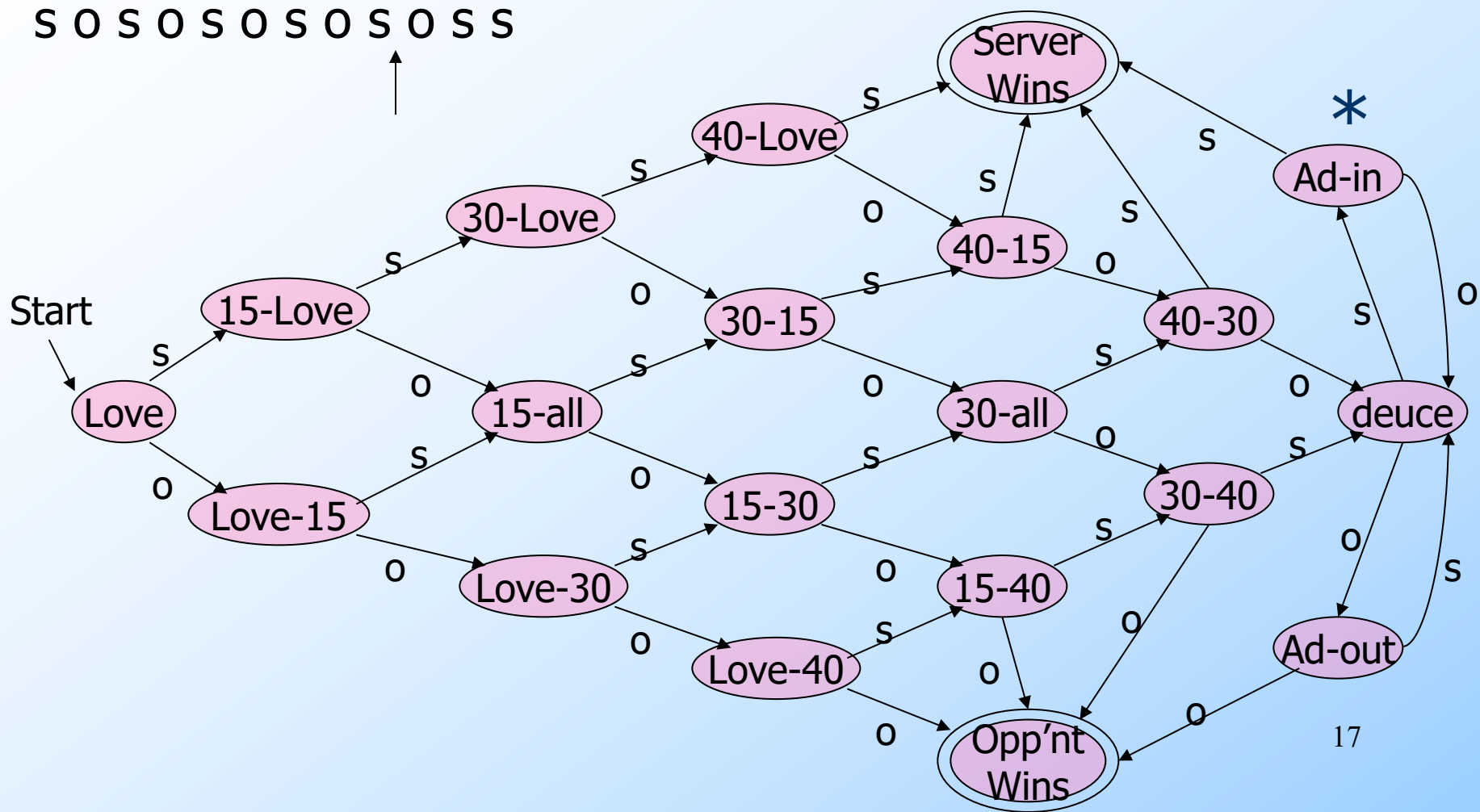


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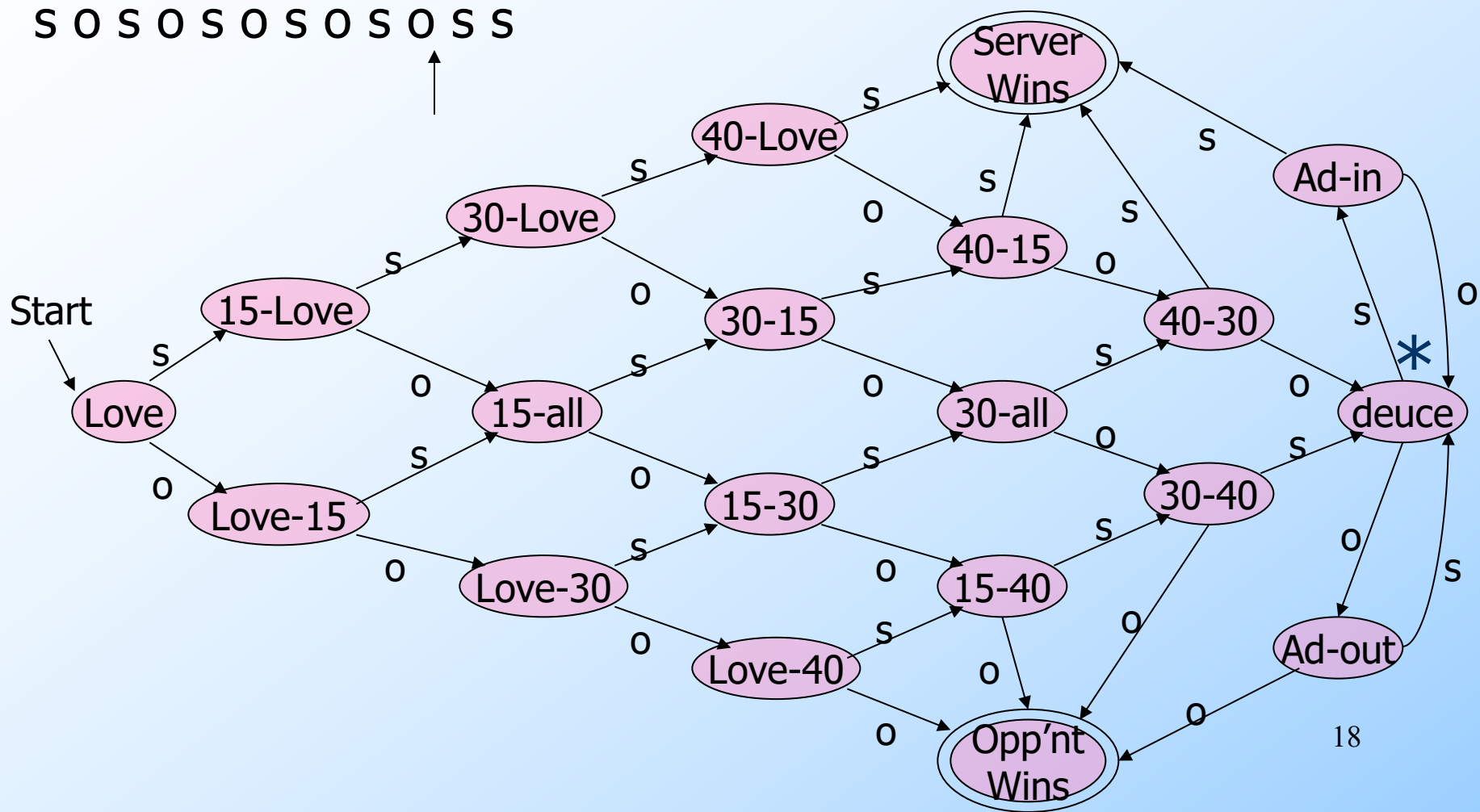




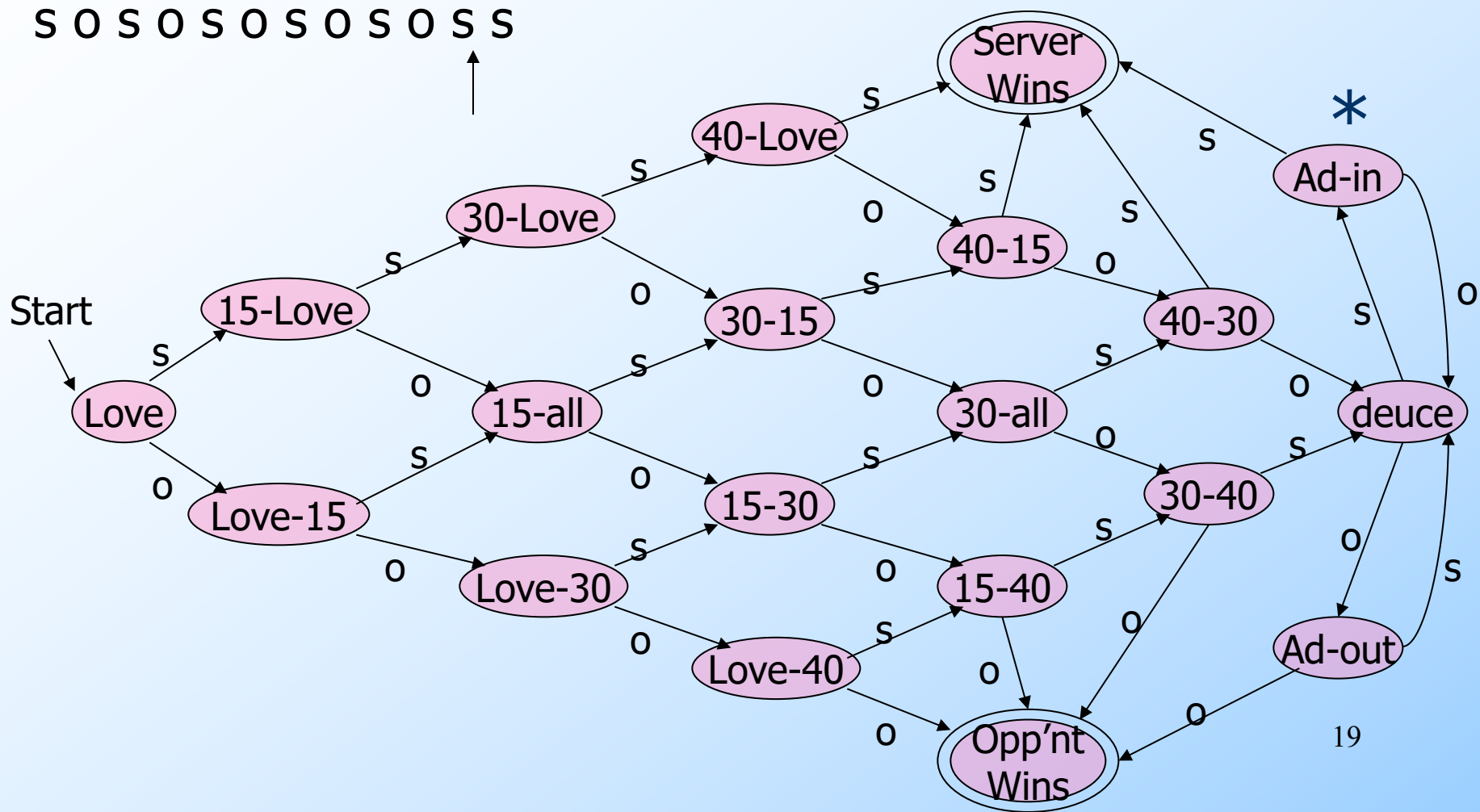
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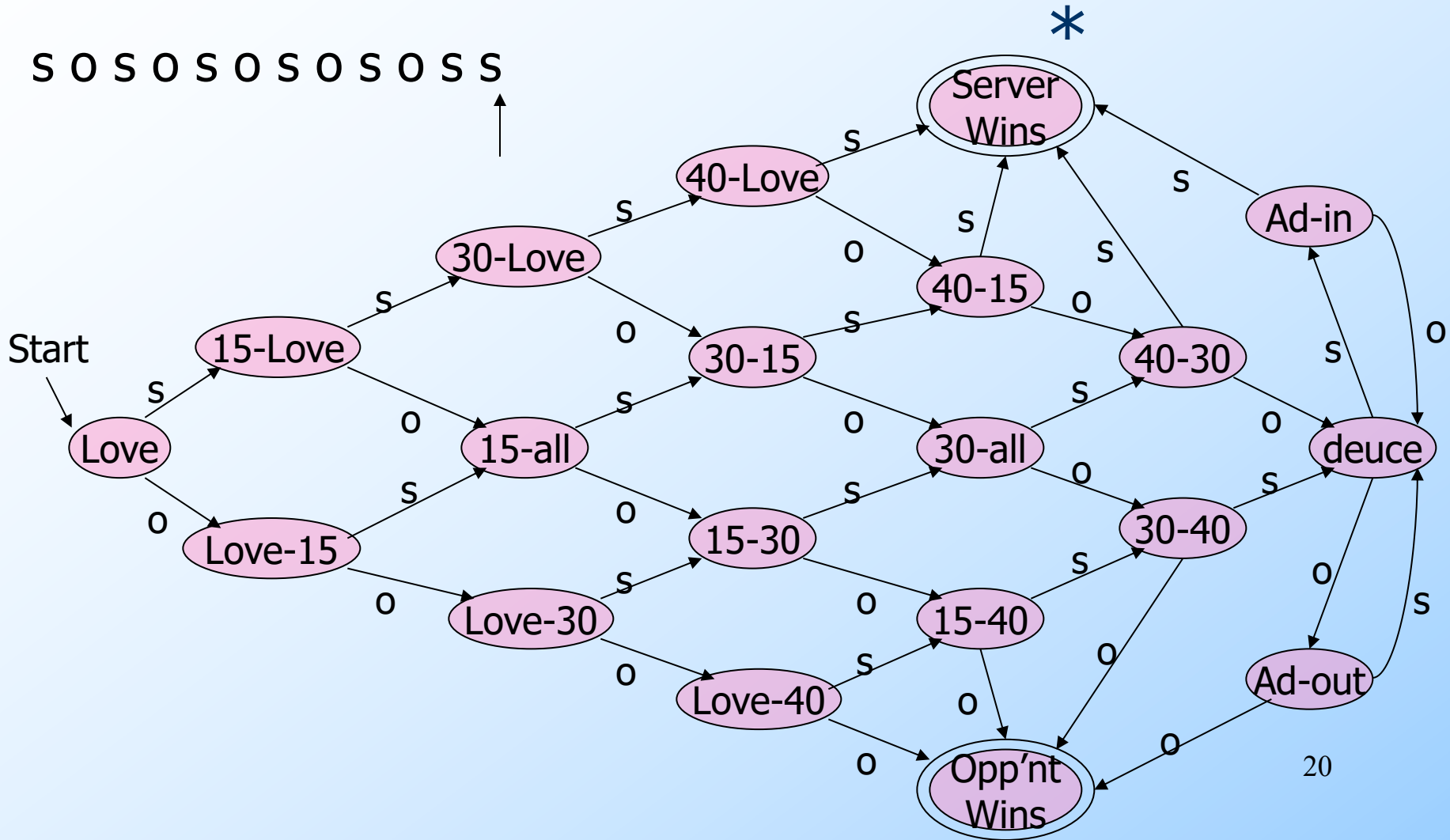
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# Language of an Automaton

- ◆ The set of strings accepted by an automaton  $A$  is the *language* of  $A$ .
- ◆ Denoted  $L(A)$ .
- ◆ Different sets of final states  $\rightarrow$  different languages.
- ◆ **Example:** As designed,  $L(\text{Tennis}) =$  strings that determine the winner.