Non-Monotonic Sequential Text Generation

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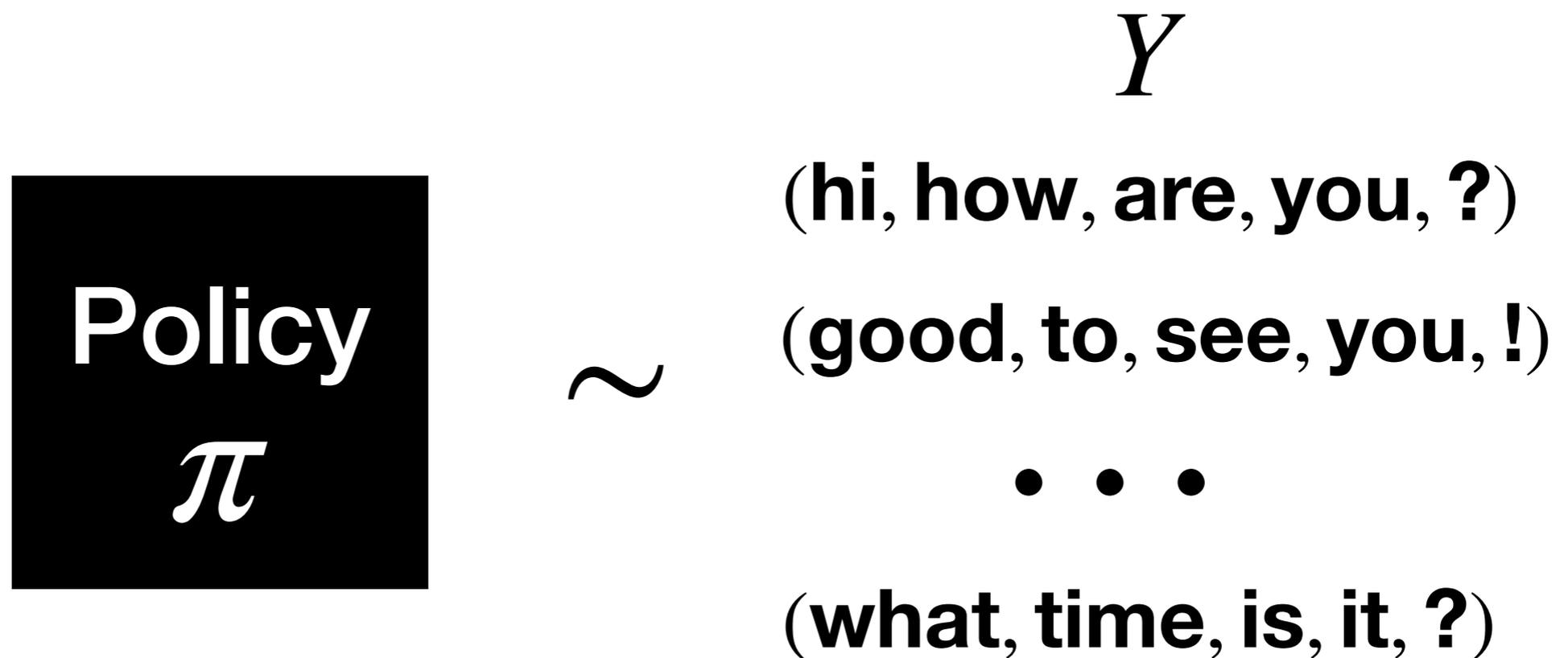
Sequential Text Generation

$$Y = (y_1, y_2, \ldots\ldots, y_N)$$

$$(\textbf{hi}, \textbf{how}, \textbf{are}, \textbf{you}, \textbf{?})$$

Sequential Text Generation

Unconditional

$$Y$$

$$
\text{Policy } \pi \sim
\begin{array}{l}
(\textbf{hi}, \textbf{how}, \textbf{are}, \textbf{you}, \textbf{?}) \\
(\textbf{good}, \textbf{to}, \textbf{see}, \textbf{you}, \textbf{!}) \\
\bullet \bullet \bullet \\
(\textbf{what}, \textbf{time}, \textbf{is}, \textbf{it}, \textbf{?})
\end{array}
$$

Sequential Text Generation

Conditional

X Y
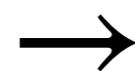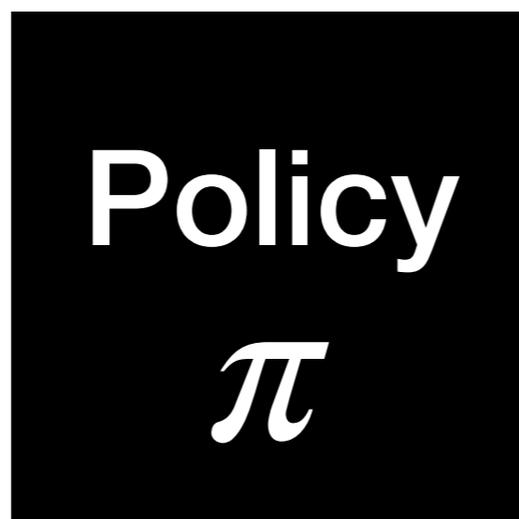
元気ですか? → **Policy** π → (**how**, **are**, **you**, **?**)

Transformer, LSTM, …

Sequential Text Generation

Monotonic

how　　　　**are**　　　**you**　　　　**?**

$$\pi(a_1 \mid s_1) \quad \pi(a_2 \mid s_2) \quad \pi(a_3 \mid s_3) \quad \pi(a_4 \mid s_4)$$

token　　　$(\textbf{how}, \textbf{are}, X)$

Sequential Text Generation

Non-Monotonic

how   are   you   ?

$\pi(a_2 \mid s_2)$ $\pi(a_1 \mid s_1)$ $\pi(a_4 \mid s_4)$ $\pi(a_3 \mid s_3)$
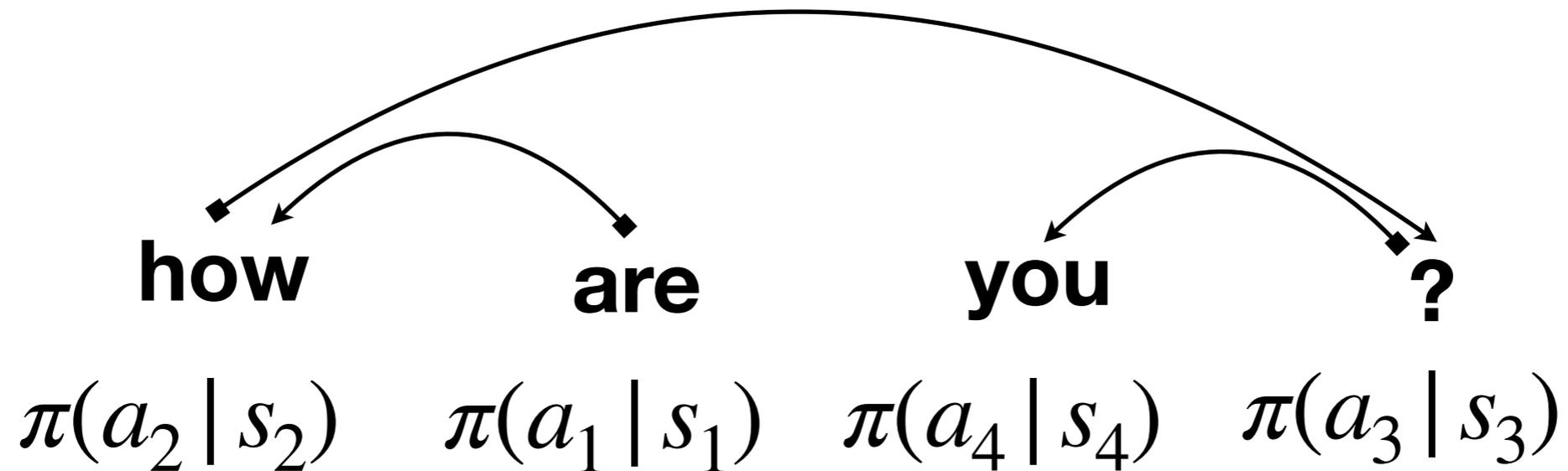
are how ? you

how are you ?

Binary Tree Generating Policy

are

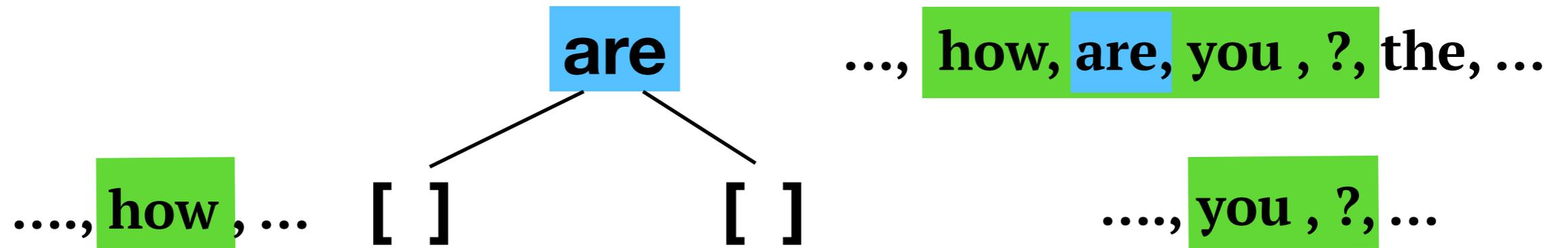...., **how** , ... [ ] [ ]
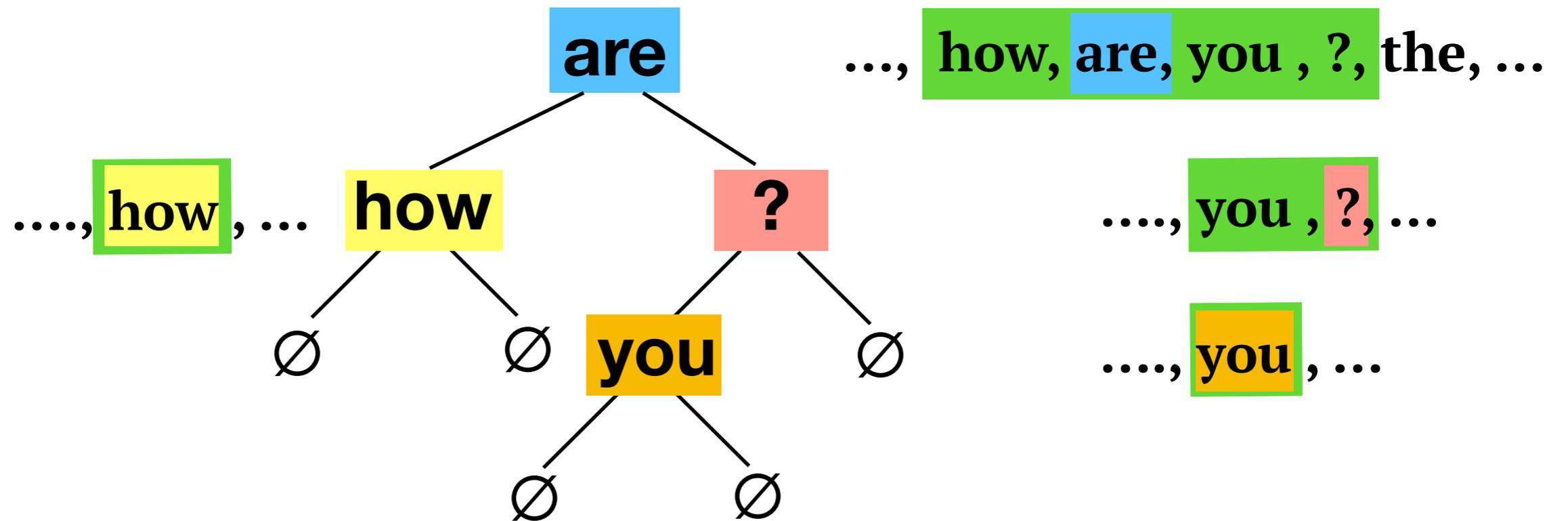
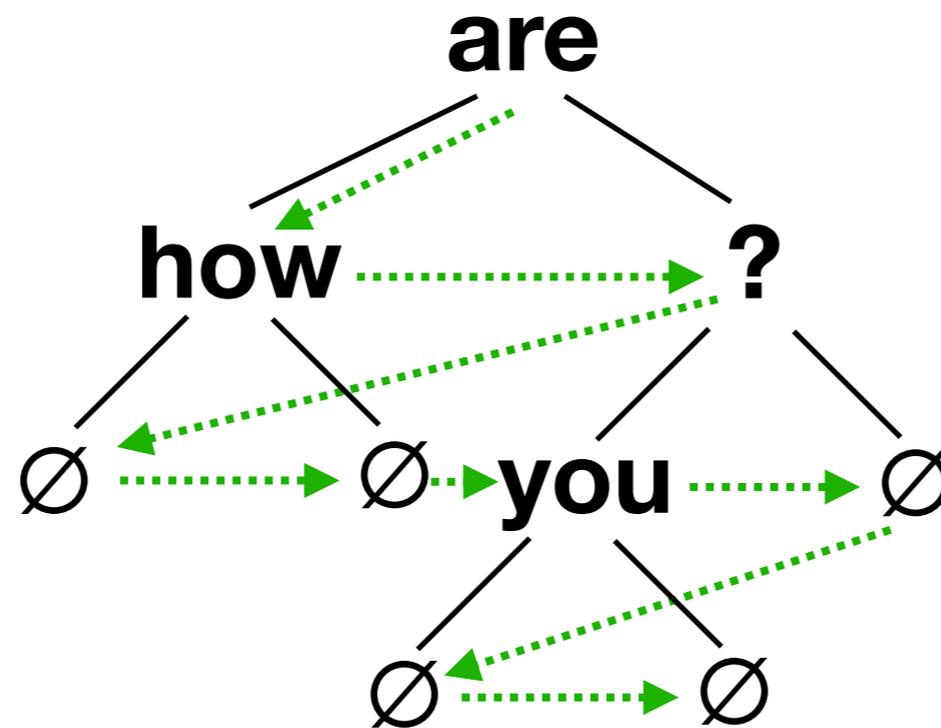..., **how, are, you , ?, the,** ...

...., **you , ?,** ...

Binary Tree Generating Policy

Binary Tree Generating Policy

Binary Tree Generating Policy
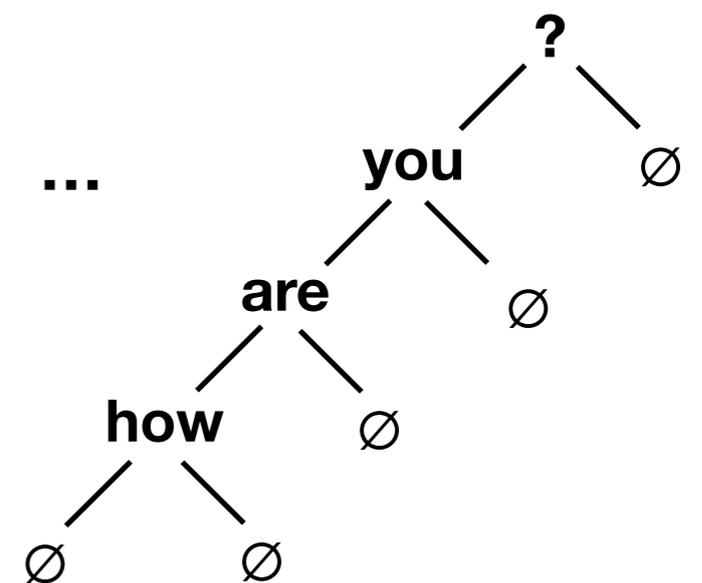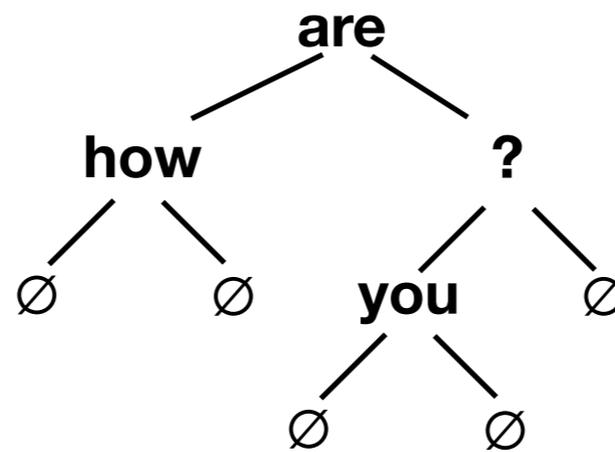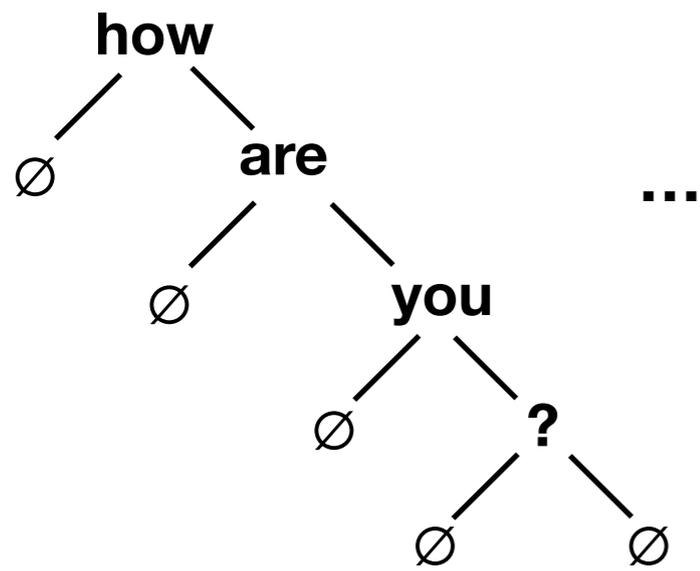
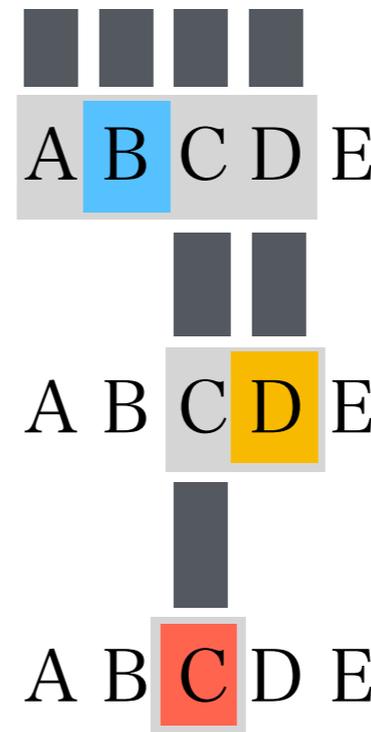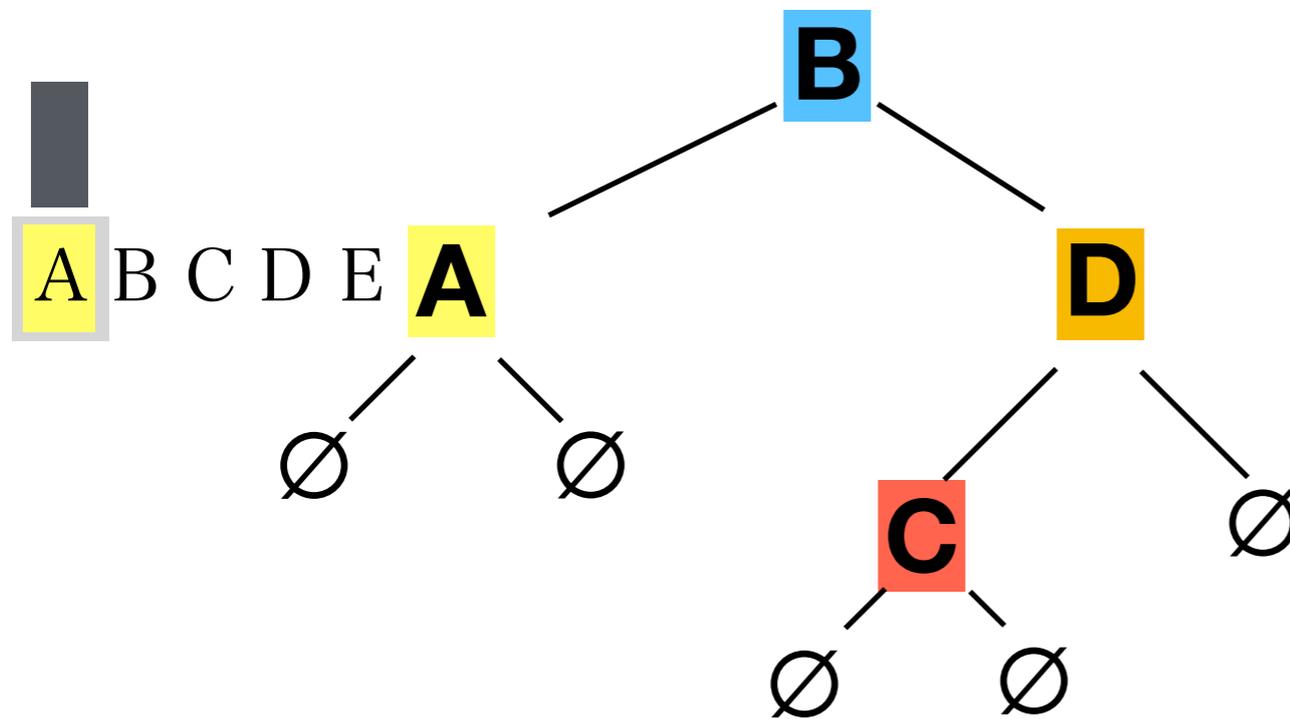# Imitation Learning

- Define an **oracle** $\pi^*(a_t \mid s_t, X, Y)$

- Sample sequences $(a_1, \ldots, a_T) \sim \pi^*$

- Minimize cost $\mathbf{KL}\left[\pi^*(\,\cdot\mid s_t), \pi_\theta(\,\cdot\mid s_t)\right]$

Oracles
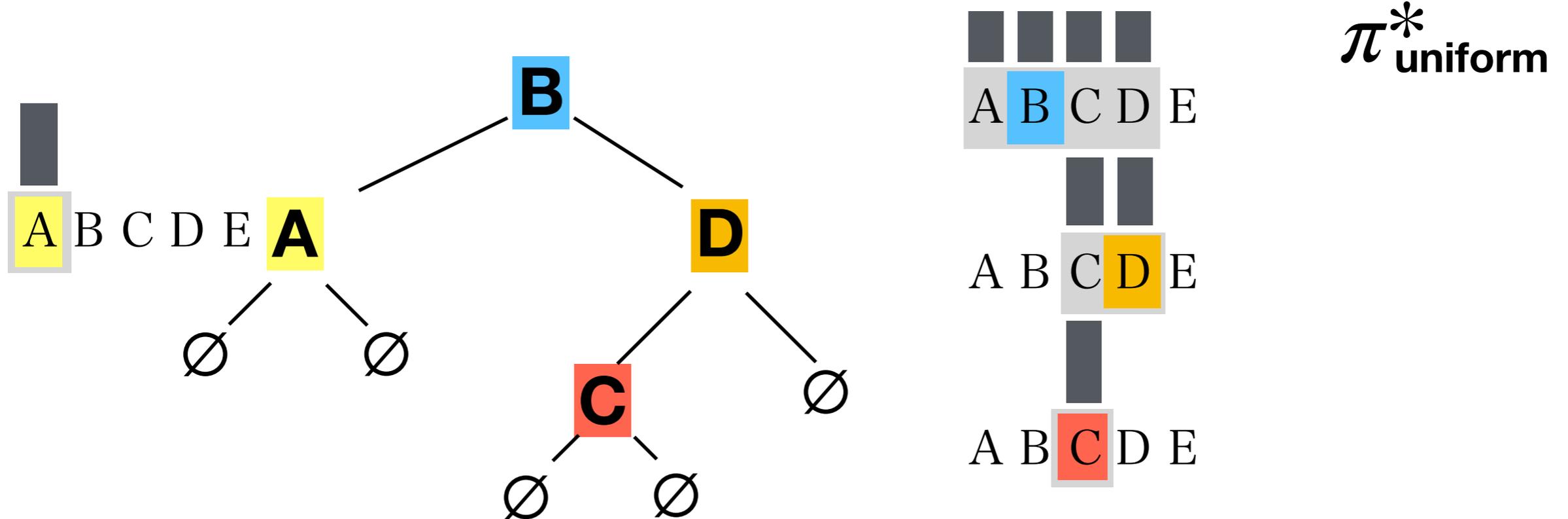
- **Oracle**: only puts mass on valid actions

Oracles

- **Oracle**: only puts mass on valid actions

$$\mathscr{L}_1 = \mathbf{KL}(\underset{\substack{A\ B\ C\ D\ E \\ \pi^*_{\mathbf{uniform}}}}{\blacksquare\blacksquare\blacksquare\blacksquare\ } , \underset{\substack{A\ B\ C\ D\ E \\ \pi_\theta}}{\ })$$

Oracles

- **left-right**: only put mass on 'left-most' valid action
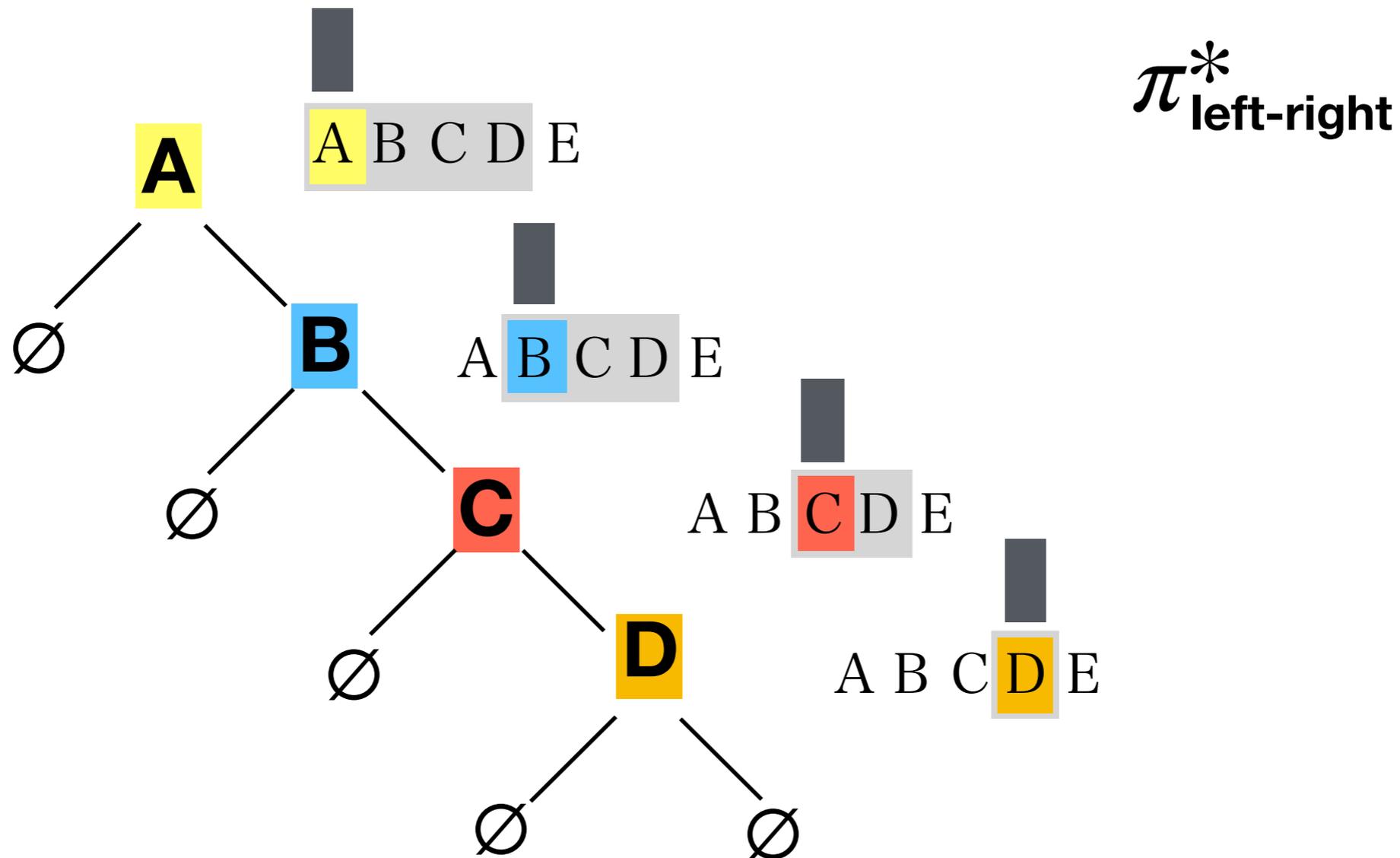
Coaching

- Weight correct actions by the learned policy

$$\pi^*_{\text{uniform}} \qquad \pi_\theta \qquad \pi^*_{\text{coaching}}$$
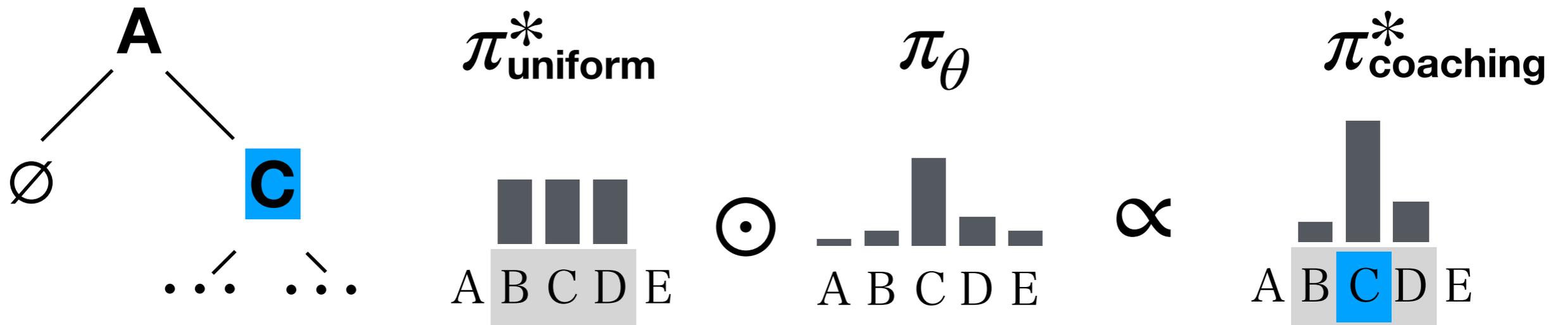
Coaching

- Weight valid actions by the learned policy
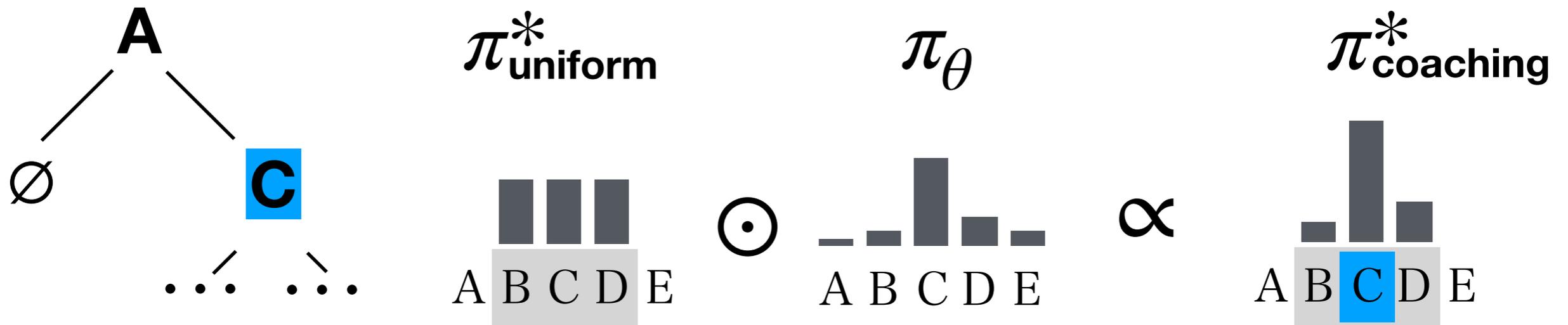
$$\pi^*_{\text{uniform}} \qquad \pi_\theta \qquad \pi^*_{\text{coaching}}$$

- Loss reinforces **preferred orders**

$$\mathbf{KL}\left(\pi^*_{\text{coaching}} \, , \, \pi_\theta \right)$$

Results | Unconditional

Sentence: i do . i like lipton beverages .
Gen. Order: . i . do i like beverages lipton

Sentence: wow you sound like that .
Gen. Order: . you wow that like sound

Results | Unconditional

Oracle	%Novel	%Unique	Avg. Tokens	Avg. Span	BLEU
left-right	17.8	97.0	11.9	1.0	47.0
uniform	98.3	99.9	13.0	1.43	40.0
annealed	93.1	98.2	10.6	1.31	56.2
Validation	97.0	100	12.1	-	-

Results | Conditional

Word Reordering

Oracle	Validation			Test		
	BLEU	F1	EM	BLEU	F1	EM
left-right	46.6	0.910	0.230	46.3	0.903	0.208
uniform	44.7	0.968	0.209	44.3	0.960	0.197
annealed	46.8	0.960	0.230	46.0	0.950	0.212

Results | Conditional

Machine Translation

Oracle	**BLEU** (BP)	**Validation** Meteor	YiSi	**Ribes**	**BLEU** (BP)	**Test** Meteor	YiSi	**Ribes**
left-right	32.30 (0.95)	31.96	69.41	84.80	28.00 (1.00)	30.10	65.22	82.29
uniform	24.50 (0.84)	27.98	66.40	82.66	21.40 (0.86)	26.40	62.41	80.00
annealed	26.80 (0.88)	29.67	67.88	83.61	23.30 (0.91)	27.96	63.38	80.91
+tree-encoding	28.00 (0.86)	30.15	68.43	84.36	24.30 (0.91)	28.59	63.87	81.64
+⟨end⟩-tuning	29.10 (0.99)	31.00	68.81	83.51	24.60 (1.00)	29.30	64.18	80.53

Results | Variable-Sized Text Infilling

Left-Right
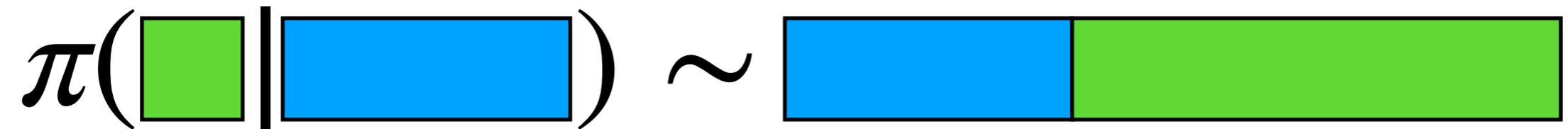
Non-Monotonic
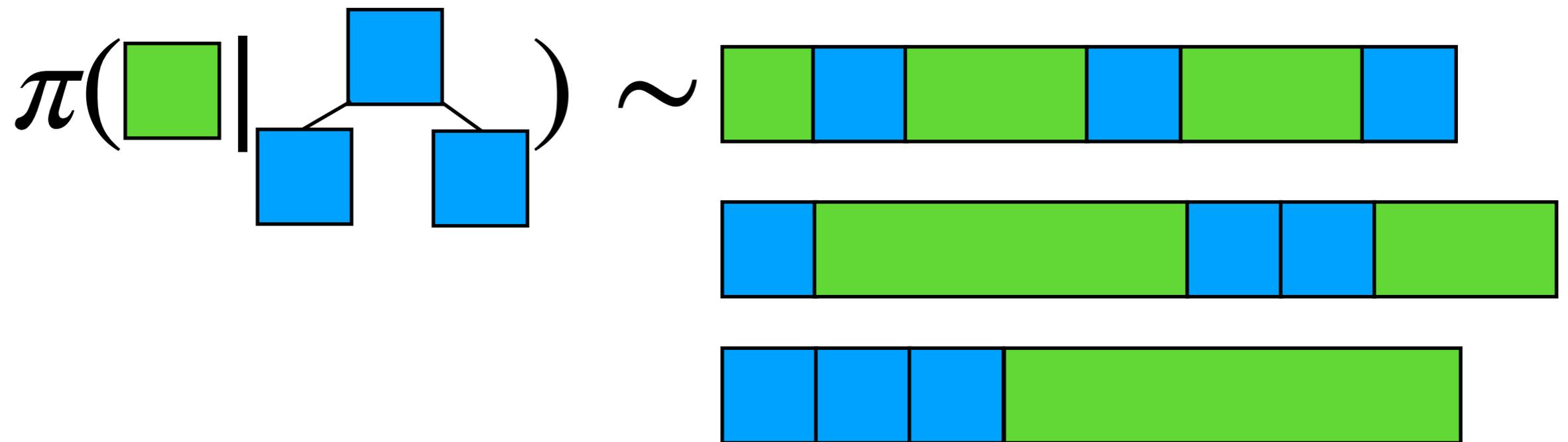
Results | Variable-Sized Text Infilling

Initial Tree

Samples

```
       ____food
     /        \
favorite       !
```
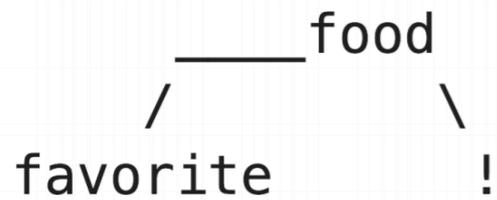
○ lasagna is my **favorite food !**

○ my **favorite food** is mac and cheese **!**

○ what is your **favorite food** ? pizza , i love it **!**

○ whats your **favorite food** ? mine is pizza **!**

○ seafood is my **favorite** . and mexican **food !**
      what is yours ?

- **Code & Pre-trained Models**:

  https://github.com/wellecks/nonmonotonic_text

- **Poster #45** (Pacific Ballroom)

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  https://github.com/wellecks/nonmonotonic_text

- **Poster #45** (Pacific Ballroom)

!

thank

you