Non-Monotonic Sequential Text Generation

Joint work with:
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Sequential Text Generation

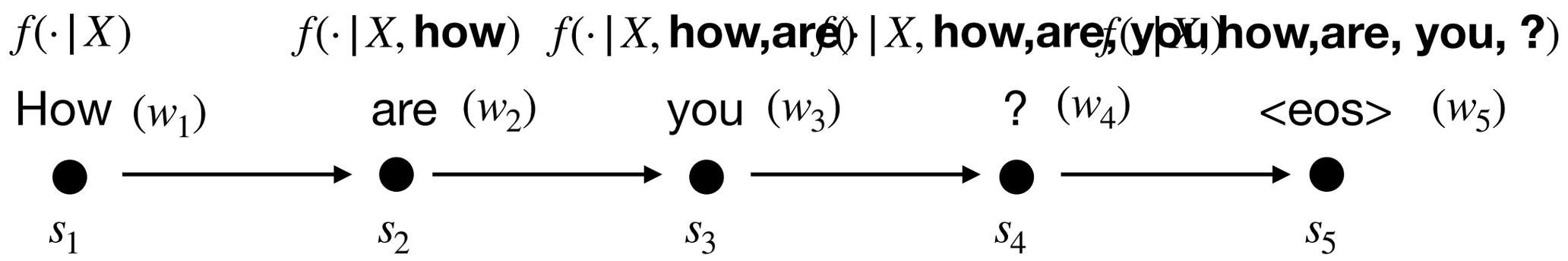
Word Descrambling: How are you ?

Sequential Text Generation

Word Descrambling:

Source: you How ? are **Target**: How are you?

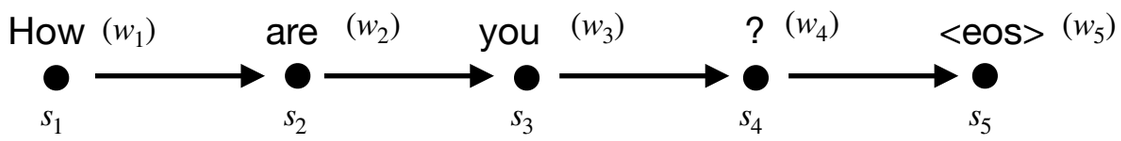
you	how	?	are	<eos>



Sequential Text Generation

Word Descrambling:

Target: How are you?



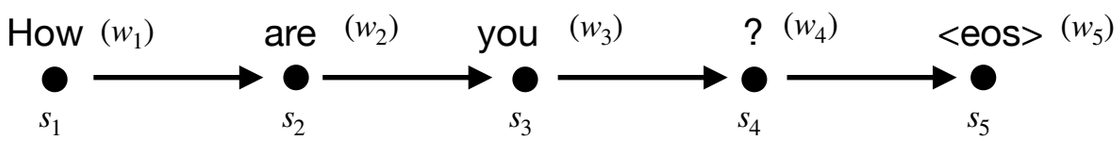
Assume: Sentence order - w_1 w_2 w_3 w_4 w_5

generation order - s_1 s_2 s_3 s_4 s_5 Monotonic

Question: Can we do sequential text generation using a non-monotonic generation order? (i.e. sentence order and generation order is different)

Imitation Learning
(Structured Prediction)

Target: How are you?



Goal: **Train π to micmic π^* using a loss function**

States: $s_1 \longrightarrow s_2 \longrightarrow s_3 \longrightarrow s_4$ Monotonic

Actions: you good ? bad orange other green words test are hi things How .....

Transition: $P(s' \mid s, \cdot)$ Fixed

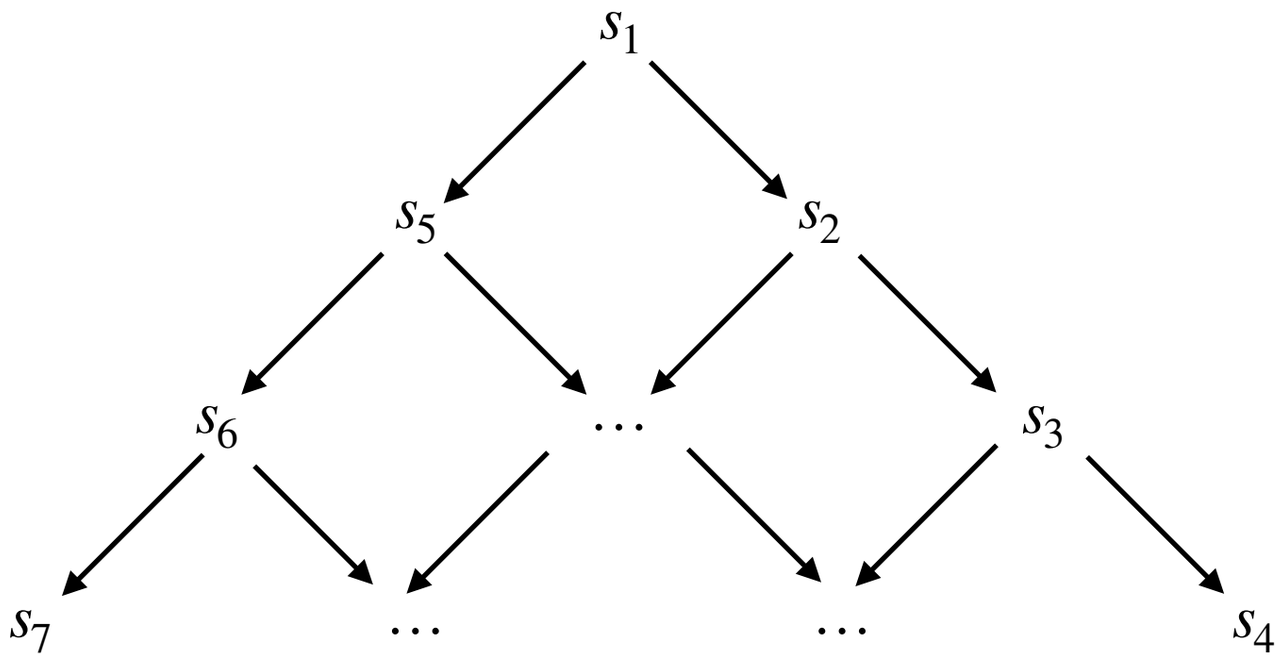
Policy: $\pi(\cdot \mid s)$

Oracle policy: $\pi^*(\cdot \mid s)$ Optimal Sequence of

Loss: $D_{KL}(\pi(\cdot, s) \mid\mid \pi^*(\cdot, s))$

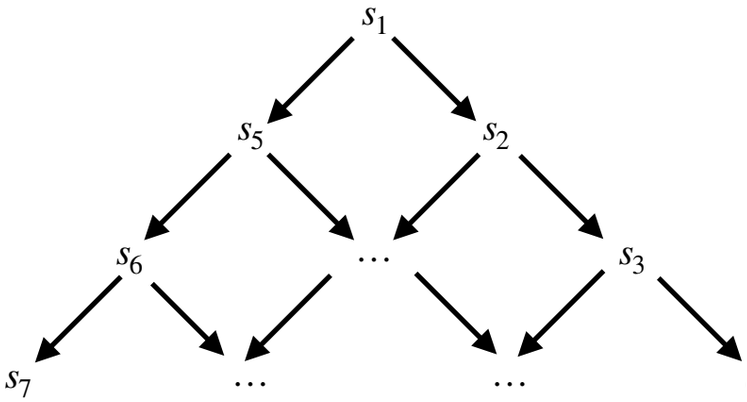
Imitation Learning
(Change State Space)

Binary Tree State Space



Oracle Polices:

Binary Tree State Space



$$\pi^*_{Uniform} = \begin{cases} 1, & \textbf{if a = <end> and } Y_t \textbf{ = <>} \\ \frac{1}{n}, & \textbf{n is the number of unique words in } Y_t \\ 0, & \textbf{otherwise} \end{cases}$$

Oracle Polices:

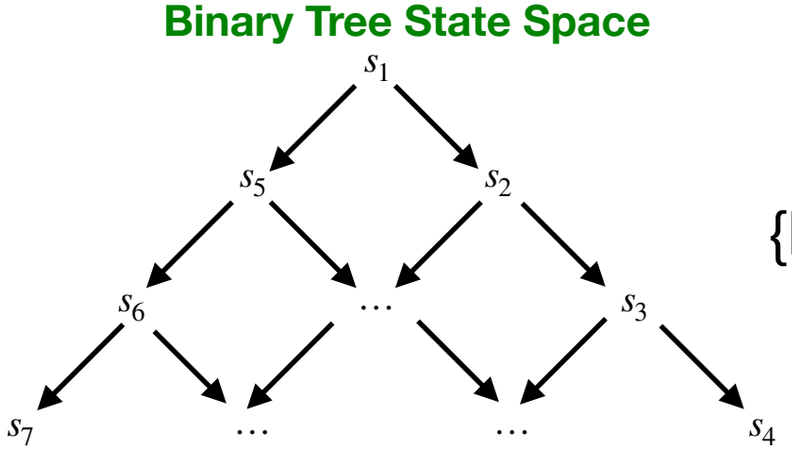
States: Not Monotonic

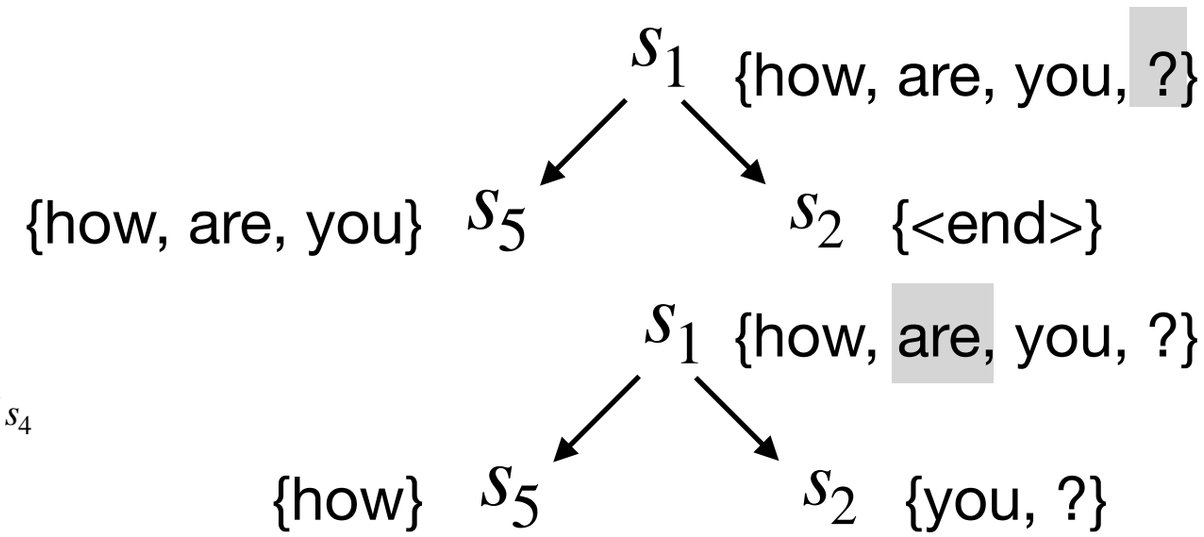
Transition: Not Fixed

Oracle policy: Optimal actions

$$\pi^*_{Uniform} = \begin{cases} 1, & \text{if a = <end> and } Y_t = <> \\ \frac{1}{n}, & \text{n is the number of unique words in } Y_t \\ 0, & \text{otherwise} \end{cases}$$

Binary Tree State Space





Oracle Polices:

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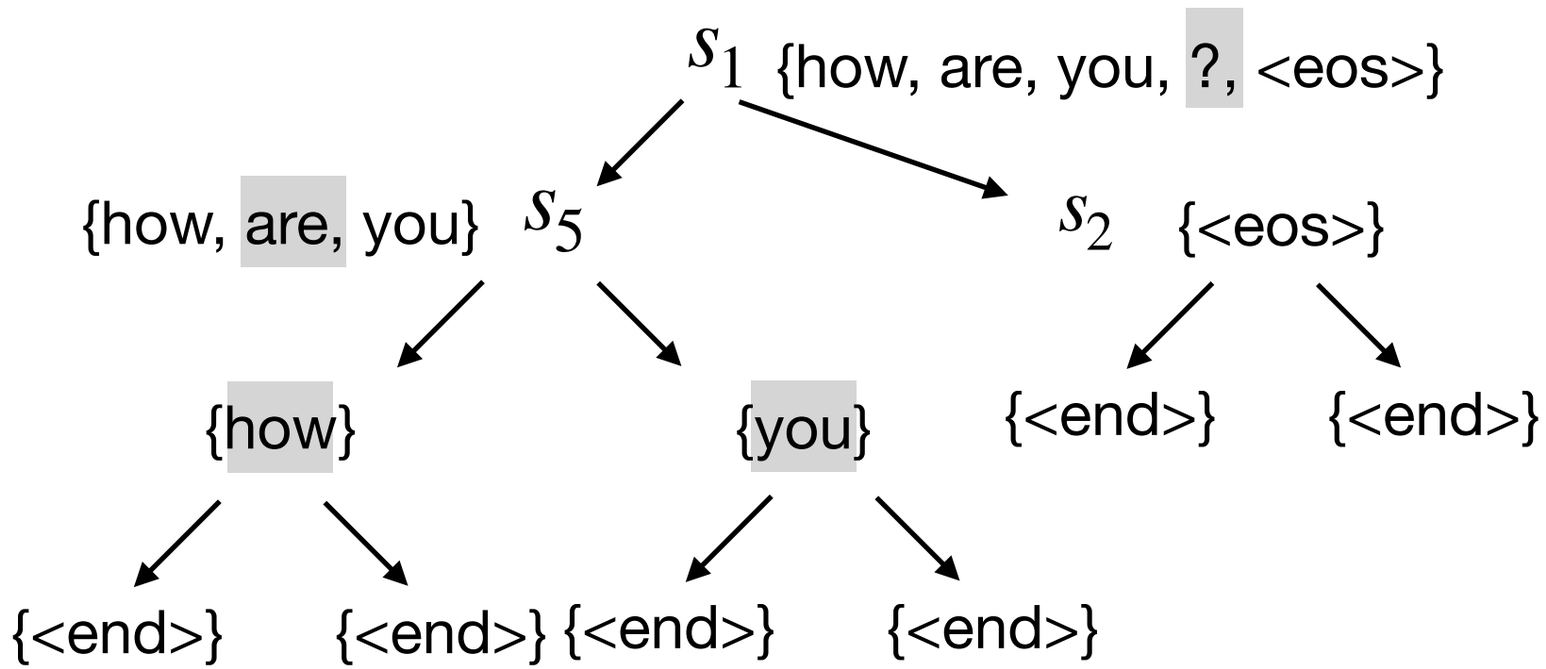
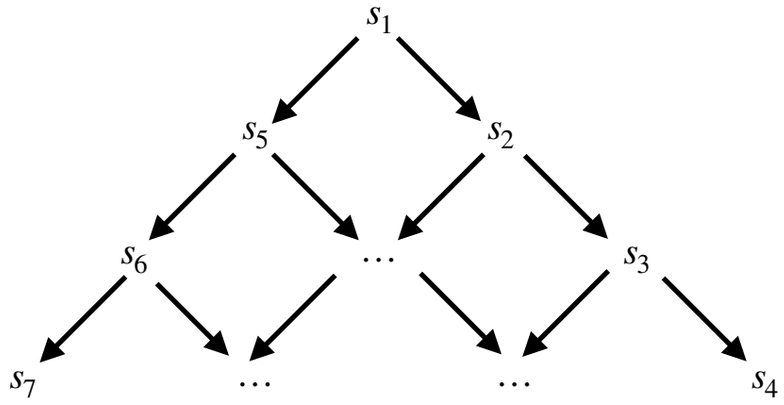


Oracle Polices:

Binary Tree State Space



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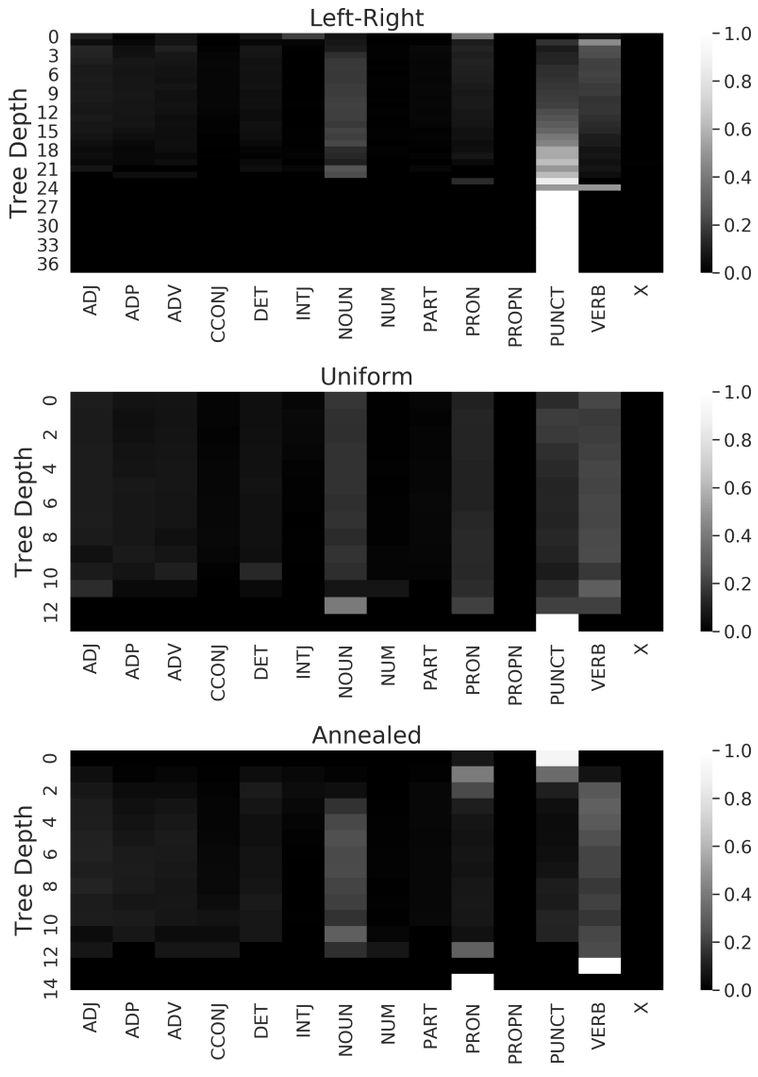
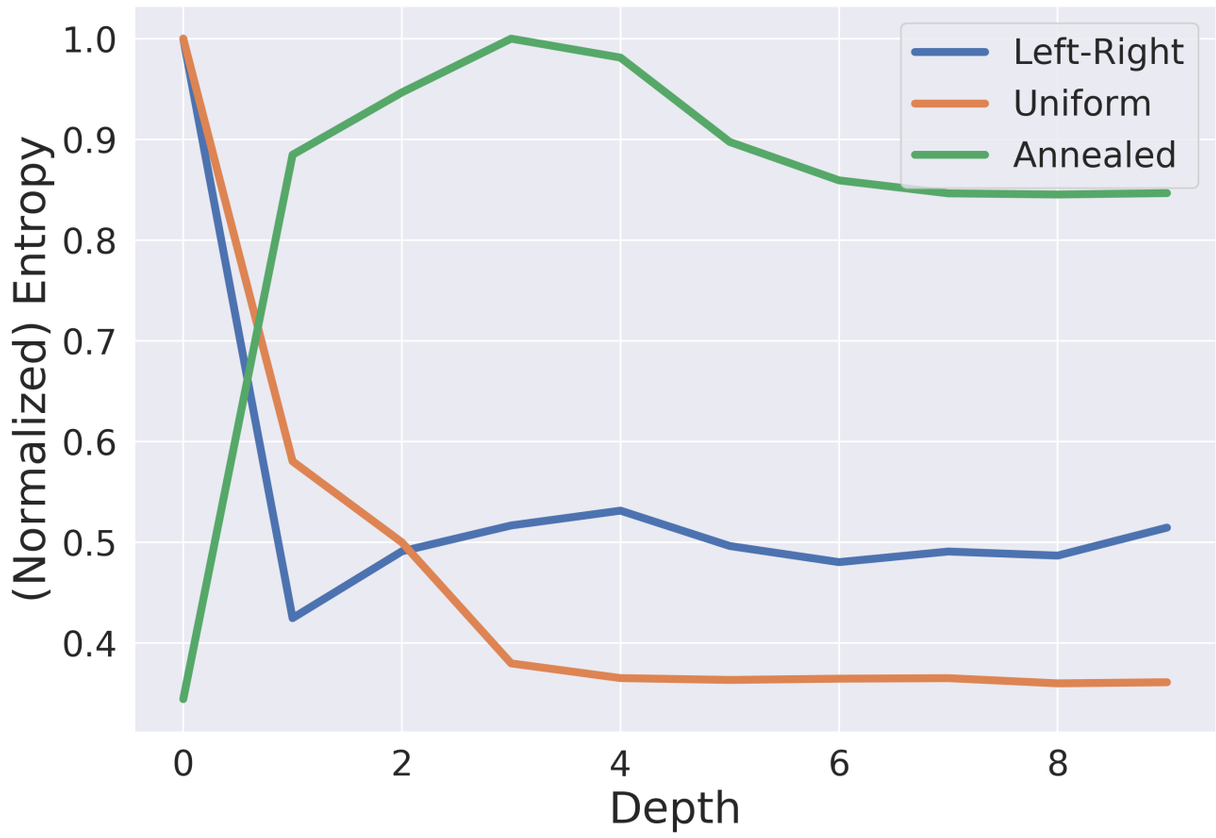
$$\pi^*_{coaching}(\cdot \mid a) \propto \pi^*_{uniform}(\cdot \mid a)\ \pi(\cdot \mid a)$$

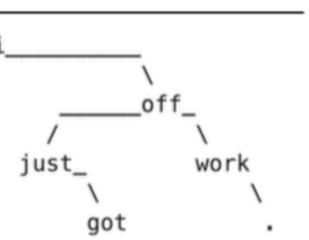
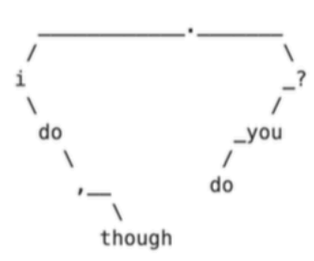
$$\pi^*_{anneal}(\cdot \mid a) = \beta \pi^*_{Uniform}(\cdot \mid s) + (1 - \beta)\pi^*_{coaching}$$

Unconditional Generation
(Language Model)





Conditional Generation
(Descrambling)

π^*	Samples	
left-right	○ hey there , i should be ! ○ not much fun . what are you doing ? ○ not . not sure if you . ○ i love to always get my nails done . ○ sure , i can see your eye underwater while riding a footwork .	
uniform	○ i just got off work . ○ yes but believe any karma , it is . ○ i bet you are . i read most of good tvs on that horror out . cool . ○ sometimes , for only time i practice professional baseball . ○ i am rich , but i am a policeman .	
annealed	○ i do , though . do you ? ○ i like iguanas . i have a snake . i wish i could win . you ? ○ i am a homebody . ○ i care sometimes . i also snowboard . ○ i am doing okay . just relaxing , and you ?	

Conditional Generation
(Neural Machine Translation)

Oracle	Validation BLEU (BP)	Meteor	YiSi	Ribes	Test BLEU (BP)	Meteor	YiSi	Ribes
left-right	29.47 (0.97)	29.66	52.03	82.55	26.23 (1.00)	27.87	47.58	79.85
uniform	14.97 (0.63)	21.76	41.62	77.70	13.17 (0.64)	19.87	36.48	75.36
+⟨end⟩-tuning	18.79 (0.89)	25.30	46.23	78.49	17.68 (0.96)	24.53	42.46	74.12
annealed	19.50 (0.71)	26.57	48.00	81.48	16.94 (0.72)	23.15	42.39	78.99
+⟨end⟩-tuning	21.95 (0.90)	26.74	49.01	81.77	19.19 (0.91)	25.24	43.98	79.24