

Input: What countries border Germany?

LF: $\lambda x. \text{country}(x) \wedge \text{borders}(x, \text{Germany})$

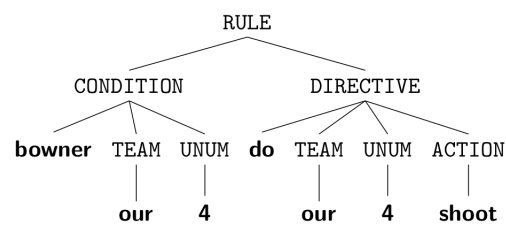
Denotation: $\llbracket \lambda x. \text{country}(x) \wedge \text{borders}(x, \text{Germany}) \rrbracket = ?$

Figure 1: **Question 1:** What is Semantic Parsing? What are the main learning settings?

Input:

(If our p 4 has the ball, our p 4 should shoot, ((bowner our{4}) (do our{4} (shoot))))

MR Grammar:



MR Grammar

RULE	→	CONDITION DIRECTIVE
CONDITION	→	bowner TEAM UNUM
DIRECTIVE	→	do TEAM UNUM ACTION
TEAM	→	our
UNUM	→	4
ACTION	→	shoot

Generative Models: CFGs, Tree Transducers, Synchronous Grammars

Figure 2: **Question 2:** How does rule extraction work?

RULE	→	CONDITION DIRECTIVE
CONDITION	→	bpos REGION ppos REGION
DIRECTIVE	→	PLAYER ACTION
UNUM	→	4
ACTION	→	shoot pass
ppos	→	PLAYER

Transformation rules	
PLAYER	→ 'p4' 'then' 'pass' 'shoots'
REGION	→ 'at the goal' 'when'
shoot	→ 'p4' 'shoots' if
pass	→ 'pass' 'then should'
λ	→ 'if' 'is' 'then' 'when'

when p4 is-at-the-goal p4 shoots.

	1	2	3	4	5
0					
1					
2					
3					
4					

Figure 3: **Question 3:** How does rule application work? What is dynamic programming? How do PCFGs works (or tree transducers)?

Goal: A dataset $D = \{(x, z)\}_1^n$, trained model (PCFG, CCG, ...) with parameters θ , prediction problem for any given input x :

$$\arg \max_d p(d \mid x; \theta) \quad (\mathbf{PCFG}, \text{derivation } d)$$

$$\arg \max_z p(z \mid x; \theta) = \sum_d p(z, d \mid x; \theta) \quad (\mathbf{PCCG}, \text{derivation } d)$$

$$\arg \max_{d \in \text{GEN}(x)} Pr_\lambda(d \mid x; \theta) \quad (\mathbf{PSCFG}, \text{derivation } d)$$

Figure 4: **Question 4:** How does prediction work?

Goal: A dataset $D = \{(x, z)\}_1^n$, and some model, we want to learn θ given some **objective**:

$$\begin{aligned}\theta^* &= \max_{\theta} \prod_{i=1}^n p(z_i \mid x_i; \theta) \\ &= \max_{\theta} \sum_{i=1}^n \log p(z_i \mid x_i; \theta)\end{aligned}$$

Figure 5: **Question 5:** How does the learning work? What is the EM algorithm? Log-linear parsing?