Lecture 37:

• Intro to Answer-Set Programming (ASP)

Announcements:

- HW-8 out
- Last (make-up) quiz on Friday

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Overview**Excall:**• Propositional logic: $p \land \neg q \rightarrow r$... $r \leftarrow p \land \neg q$ • Predicate logic: $p(x, y) \land \neg q(y) \rightarrow r(x)$... $r(x) \leftarrow p(x, y) \land \neg q(y)$ **Basic Idea of Logic Programming (LP):**• Use logic-based syntax and semantics as a computational model(s)• Programs as sets of "facts" (data) and "rules" (possibly recursive)**Examples of LP in practice:**• SQL (although not immediately obvious)• Datalog (DB query language, focus on recursion)• Prolog (one of the first mainstream LP languages)• Answer Set Programming (disjunctive Datalog as a PL) DLV, Clingo• Many new systems (declarative data science, neurosymbolic AI, etc.)

Overview

otass	co Answer-Set Programming (ASP) tools:	see potassco.org
• we	e'll look at clingo but various other tools	
• do	wnload using conda, homebrew, ubuntu apt, etc.	
• ca	n use within python (clingo api)	
• ca	n use via web at potassco.org/clingo/run/ or ASP c	chef
Design	ed for solving <i>combinatorial optimization</i> problems	
• fir	• find optimal (min/max/best) solution from (finitely) many possibilities	
• of	ten NP-Complete problems, e.g., vehicle routing, sch	neduling, games,
ASP pi	ograms expressed in <i>Guess-and-Check / Generate-</i>	and-Check style
1.	Select and transform input data	query-like
2.	Generate possible solutions	"guess" phase
3.	Filter those that satisfy certain solution properties	"check" phase
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Overview

Exercise: sketch an algorithm that:

- takes a graph as input (with nodes and edges)
- assigns colors (R, G, B) to nodes where no adjacent nodes have same color





A (naive) "greedy" approach:

... note 3-colorability is NP-Complete!

- 1: For each node $x_1 \dots x_n$ in order
- 2: set $color(x_i)$ based on color of x_i 's neighbors
- 3: if no possible color for x_i , backtrack to x_{i-1}
- 4: if backtrack to x_1 , graph is not 3-colorable



Exercise: Sketch algorithm for xkcd.com/287/ given any menu and total price





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Overview





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