

No One SATPlan Encoding To Rule Them All

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What is Planning?

- World state: instantiation of multivalued state variables
- Actions:
 - require certain values of state variables to be used (preconditions)
 - change values of state variables by their effects
- Objective:
 - Given a set of actions
 - Given an initial state (start) and goal conditions
 - Find a plan (sequence of actions to get from start to goal)

- If the formula F_k is satisfiable then a plan (of length k) exists
- Solve F_1, F_2, \dots until a satisfiable formula F_n is reached
- From a satisfying assignment of F_n construct a plan

Encoding

- The encoding = How is F_k defined
- The key aspect for the performance
- Many encodings invented in the last decades
- Each aims to be better than the others on all problems

General Idea

- No one encoding can rule them all
- Take a set of encodings
 - Diversify! Diversify! Diversify!
 - Taking the best existing encodings is not that good
- Create a (heuristic) rule to select the best encoding for a problem
 - Rule should be simple – fast to evaluate
 - Rule should be smart to select well

Implementation

- Used Encodings:
 - $R^2\exists$ -Step encoding with
 - Topological ranking
 - Input ranking
 - Reinforced encoding
- Selection Rule:
 - 1 T = number of transitions
 - 2 if $T > 10$ use Reinforced
 - 3 else use $R^2\exists$ -Step alternate between the two rankings for each makespan

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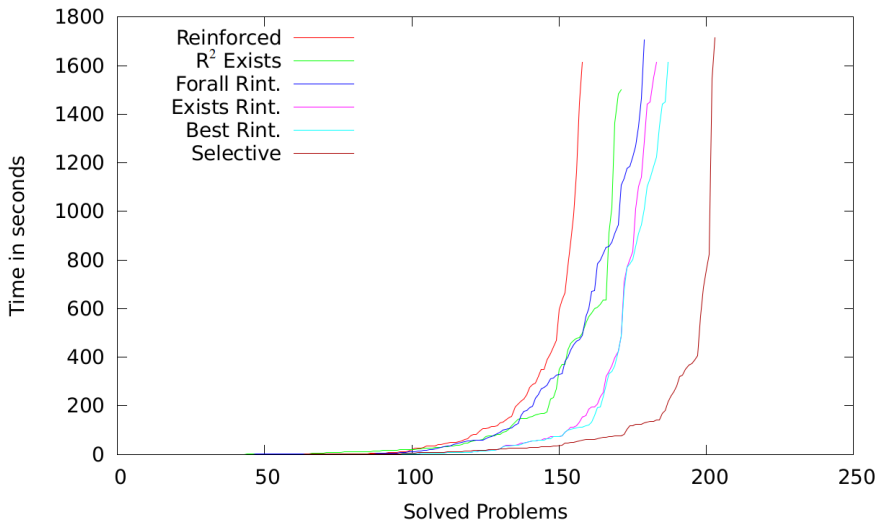
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Experiments

- Number of solved problems within 30 minutes
- We Compared
 - Selective encoding
 - Its components
 - State-of-the-art Rintanen encodings
 - Their optimal combination (R^*)
- IPC 2011 Benchmarks, 20 problems in each of 14 domains

Domain	Reinf	$R^2\exists$	Sel	$R\forall$	$R\exists$	R^*
barman	4	8	9	8	4	8
elevators	20	20	20	20	20	20
floortile	18	18	18	16	20	20
nomystery	20	6	20	20	20	20
openstacks	0	15	20	0	0	0
parcprinter	20	20	20	20	20	20
parking	0	0	0	0	0	0
pegsol	10	19	19	11	12	12
scanalyzer	15	9	15	17	18	18
sokoban	2	2	2	6	6	6
tidybot	2	2	2	13	15	15
transport	18	13	19	18	18	18
visitall	10	20	20	11	11	11
woodworking	20	20	20	20	20	20
Total	159	172	204	180	184	188

Experiments - Coverage Plot



- Combining diverse encodings is a perspective research direction
- Just combining the best (Rintanen) encodings is not optimal
- The proposed rule is very simple and the encoding pool small, but already the experiments show great improvement
- Future Work
 - Bigger and more diverse encoding pool
 - More sophisticated selection rules