International Planning Competition 2026
Numeric Tracks

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Numeric Planning Problem

Numeric Planning Problem $\Pi = \langle F, X, A, I, G \rangle$

- F: Boolean state-variables
- X: numeric state-variables
- Let Φ be the set of Boolean conditions over F and **linear** numeric expressions
  - → E.g., $(x + y \leq 5) \vee (a \wedge b)$
- A: a set of actions $\langle \mathrm{pre}, \mathrm{eff}, c \rangle$ where c is a positive constant cost, and:
  - → $\mathrm{pre} \in \Phi$
  - → eff is a set of assignments $v \leftarrow \xi$, where:
    - $\xi \in \{\top, \bot\}$ if $v \in F$
    - ξ is a **linear** numeric expression if $v \in X$
- $G \in \Phi$: the goal
- I: an initial assignements to all variables in $F \cup X$.

A solution is a sequence of actions π all executable from I and that satisfy G

The cost of π is $\sum_{a \in \pi} c(a)$, and the optimal plan has minimal cost

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Subtracks

Agile
- Find a valid plan as quickly as possible.
- Timeout: 5 minutes.
- Score: $1 - \log(T)/\log(300)$, where T is the planner runtime.

Satisficing
- Find high-quality plans.
- Timeout: 30 minutes.
- Score: C^*/C, where C^* is the best known cost and C is the planner cost.

Optimal
- Find optimal plans.
- Timeout: 30 minutes.
- Score: 1 if the task is solved optimally, 0 otherwise.

Similarly to the IPC23, we have dedicated **Simple Numeric Planning (SNP) subtracks** [Helmert 2002; Hoffmann 2003; Scala, Haslum, and Thiébaux 2016]

- Restrict effects to be **increase/decrease by a constant**, e.g., $x \leftarrow x + 5$.

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Participants I

Team	Planner	Subtracks: agl	Subtracks: sat	Subtracks: opt	#config
2	PATTY	✓	✓		4
3	Panino	✓	✓		2
4	TamerLite	✓	✓		4
5	Tyr	✓	✓	✓	6
6	nplanning	✓	✓		4
7	Count Downward	✓	✓	✓	4
8	PlanForge	✓	✓	✓	4
9	PATTYINT	✓			1
11	Count Downward Together			✓	2
12	Tempest		✓		1
	Total configurations				32

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Participants II

- **19 authors from 11 institutions**: Università degli Studi di Genova, University of Melbourne, RMIT University, Fondazione Bruno Kessler, Linköping University, Australian National University, Heidelberg University, Technion, Bar-Ilan University, Universidad Carlos III de Madrid, University of Malta.
- **Technologies and systems:** Numeric Fast Downward; ENHSP; Patty; jpddlplus; Unified Planning; TAMER; PPMaJaL; Bitwuzla/pySMT; RUST/C++/Java/Python implementations;
- **Methodologies:** heuristic search; SMT and symbolic planning; pattern-based planning; abstraction heuristics; relaxation heuristics; numeric reasoning; lifted planning; symmetry detection; landmarks and macro-actions; dominance pruning; novelty and width-based exploration; resource reasoning; numeric canonicalisation.

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- **Technologies and systems:** Numeric Fast Downward; ENHSP; Patty; jpddlplus; Unified Planning; TAMER; PPMaJaL; Bitwuzla/pySMT; RUST/C++/Java/Python implementations;
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A sincere thank you to all participants!

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Overview: Domains

Domain	Origin	is SNP?
forestfire	From literature	Yes
line-ex.-snp	From literature	
onlycraft	Inspired from literature	
petri-net	From literature	
settlers-snp	From literature	
expedition	Previous IPC	
2048	Novel⋆	No
coins	Novel⋆	
factory-robot	Novel	
gear-car	Novel	
rainbowttle	Novel⋆	
sailing-wind	Novel	
ztalloc-sum	Novel⋆	

⋆ Submitted novel domain.

A big thanks to all contributors!

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Onlycraft

Inspired by the domain of Benyamin, Yarin; Mordoch, Argaman; Shperberg, Shahaf; Piotrowski, Wiktor; Stern, Roni

Image from "Crafting a Pogo Stick in Minecraft with Heuristic Search"

Collect resources. Craft objects.

- Original domain: collect resources and craft one object.
- Our variant: multiple target objects.
- Additional challenge: recipes can lead to dead ends.

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Summary:

- A numeric planning model of the 2048 sliding tile puzzle
- Tiles are moved individually in four directions. Equal adjacent tiles merge
- The goal is to create a target board configuration.

Example:

Initial board

$$\begin{bmatrix} 32 & 64 & 16 & 8 \\ 32 & 16 & 16 & 32 \\ 8 & 32 & 32 & 32 \\ 64 & 32 & 64 & 32 \end{bmatrix}$$

Goal board

$$\begin{bmatrix} 512 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Challenging to ground!

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Coins

Connor Little

Problem

- Given a set of coin denominations, construct a target value.
- Using the same denomination multiple times increases the cost of that denomination.
- Feasible solutions are easy to find; optimal solutions are harder.

Key Action: `addCoin(c)`

- Add coin value
- Increase penalty

Encoding Idea

Repeated use of the same denomination becomes increasingly expensive. The cost of actions is accumulated based on the penalty using a sequence of *extra actions*.

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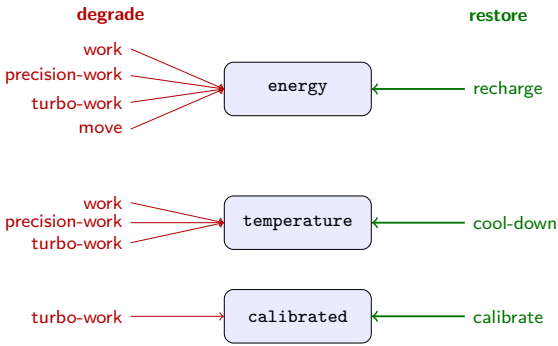
Robots `move` along a station network (one per station), driving each robot's `workload` to a target while keeping temperatures safe.

Work: grow `workload`, degrade state `work`, `precision-work`, `turbo-work`

Support: restore state `recharge`, `cool-down`, `calibrate`

Goal: reach the target workload, keeping `temp` $\leq$ `max-temp`



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Inspired by the sailing domain from Enrico Scala and Miquel Ramirez
Boat movement: move-0, move-15, move-30, ..., move-345

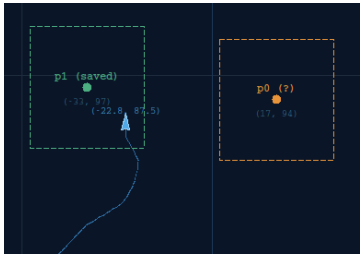
- Can adjust direction by 15°
- Displacement based on velocity

Key feature: velocity controlled by geometric equations

- $\mathbf{v} = (v_{max}^{15} * (1 - r)) + (r * \mathbf{v})$

Goal: save all people

- Must slow to a certain velocity
- Only way is move-0 (sailing towards wind)



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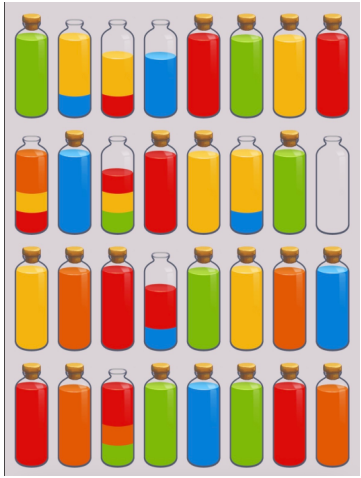
- **Inspired by a puzzle game**
- Actions move colored liquid from one bottle to the other
- **Goal:** all bottles must be empty or have uniform color



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Based on the inverse Collatz conjecture
Given a number x, reach a value t with the operations:

- $x = x * 2$
- $x = (x - 1)/3$

Operation $x = (x - 1)/3$ unfolded into a sequence of actions to emulate and enforce integer division.
Sum *variation*: given a set of variables $x_1, x_2, \ldots, x_n$ achieve:

$$\sum_{i=0}^{n} x_i = t$$

using the two operations above.

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Overall Award

Agile Track

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Total score:

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Overall Award

Agile Track

Winner

Panino

Total score: **100.592/260**

Authors:

Giacomo Rosa, Jean Honorio, Nir Lipovetzky, Sebastian Sardiña

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Overall Score Rank

Agile Track

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Panino	1.273	15.599	7.106	11.935	3.445	2.623	4.901	**17.742**	**8.536**	1.707	6.637	**6.261**	**12.827**	100.592
ENHSP ICAPS 2025	0.972	**16.342**	7.158	**13.501**	10.910	2.876	3.380	17.706	5.254	3.475	5.022	4.123	9.204	99.923
nplanning-agl-1	2.372	12.949	6.774	3.143	3.596	0.724	0.000	17.660	2.132	8.443	4.205	1.670	9.877	73.545
ENHSP 2024 P($3h$||$3n$)	2.442	12.343	8.529	5.535	0.000	0.384	1.375	11.918	4.270	**10.029**	4.392	0.391	9.654	71.260
Tyr-agl-ground	**5.543**	14.860	6.942	1.712	0.090	0.135	**20.000**	4.768	2.017	0.000	**12.930**	0.000	0.000	68.999
nplanning-agl-2	2.313	13.892	6.895	2.725	3.030	0.177	0.000	15.785	1.924	3.716	4.074	1.779	10.198	66.508
PattyInt	1.815	5.219	**14.728**	13.479	2.362	0.000	0.000	3.768	2.515	1.760	0.000	0.000	0.000	45.647
Patty_{B}	1.604	3.683	11.680	7.643	**12.446**	**2.999**	0.000	0.000	3.302	0.000	0.000	0.000	0.000	43.357
TamerLite-agl-1	1.457	0.549	4.350	7.003	0.029	1.156	0.000	14.383	3.251	0.000	1.847	0.000	8.961	42.987
Patty_{G}	1.010	4.200	11.946	8.097	12.148	2.453	0.000	0.000	0.986	0.000	0.000	0.000	0.066	40.905
TamerLite-agl-2	2.743	5.810	3.627	2.142	0.000	1.114	0.000	4.068	3.212	0.596	2.149	0.000	9.203	34.664
Tyr-agl-lifted	0.042	0.386	2.989	1.000	0.000	0.816	2.064	2.922	1.995	0.000	8.184	0.000	0.000	20.399

- ENHSP ICAPS 2025 → Scala and Bonassi 2025
- ENHSP SoCS 2024 → Chen and Thiébaux 2024

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Winner

Panino-anytime

Total score: **177.863/260**

Authors:

Giacomo Rosa, Jean Honorio, Nir Lipovetzky, Sebastian Sardiña

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Panino-anytime 🥇	2.156	15.951	13.868	**18.451**	3.702	**8.701**	**20.000**	**18.569**	**17.935**	15.723	13.714	**9.094**	**20.000**	177.863
ENHSP 2024 P($3h$||$3n$)	2.842	10.996	12.701	11.261	0.000	0.966	15.285	17.277	12.701	**19.104**	11.599	1.686	10.660	127.077
nplanning-sat-2 🥈	2.961	16.463	9.809	5.742	5.000	2.000	16.806	17.978	5.656	10.949	9.911	0.974	6.403	110.652
ENHSP ICAPS 2025 -anytime	1.962	11.205	8.303	15.385	**10.142**	3.041	15.695	6.982	4.046	11.671	7.398	2.469	7.290	105.588
TamerLite-sat-2 🥉	4.736	12.605	11.591	13.000	5.000	2.963	0.000	17.524	7.000	0.900	5.919	0.000	12.426	93.664
Tyr-sat-ground	**7.321**	**17.765**	13.277	2.000	2.000	0.875	14.618	7.927	3.761	0.000	**14.736**	0.000	0.000	84.278
nplanning-sat-1	0.685	10.938	8.228	5.774	3.202	2.000	17.039	1.614	5.698	10.478	9.978	0.974	6.403	83.010
TamerLite-sat-1	4.760	11.635	11.597	4.000	5.000	3.963	0.000	8.728	7.000	0.903	5.919	0.000	12.568	76.073
$\text{PATTY}_{\text{B}}^{\text{C}}$	3.816	9.047	**20.000**	10.471	7.790	6.217	0.000	0.000	5.996	0.000	0.000	0.000	1.747	65.084
$\text{PATTY}_{\text{G}}^{\text{C}}$	1.816	10.233	18.802	12.807	7.380	4.298	0.000	0.000	1.036	0.000	0.000	0.000	3.481	59.853
Tyr-sat-lifted	0.731	0.992	3.541	0.833	0.750	1.000	13.067	5.903	2.000	0.000	11.515	0.000	0.000	40.333

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Winner

Tyr-opt-ground

Total coverage: **83/260**

Author:

Dominik Drexler

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Tyr-opt-ground	**6**	**9**	**6**	**2**	**3**	0	**20**	**7**	**2**	0	**10**	**10**	**8**	83
$A^{\star}(h^{blind})$	5	7	3	**2**	2	0	**20**	6	0	**10**	6	8	5	74
Tyr-opt-lift	5	6	4	**2**	**3**	0	**20**	6	0	0	**10**	9	6	71

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Count Downward-agl

Total score: **65.272/120**

Authors:

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SNP Score Rank

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Planner	expedition	forestfire	line-ex.snp	onlycraft-sat	petri-net	settlers-snp	Σ
Count Downward-agl 🥇	2.205	17.714	4.135	**14.633**	**17.179**	**9.406**	65.272
ENHSP ICAPS 2025	0.972	16.342	7.158	13.501	10.910	2.876	51.759
PlanForge-agl 🥈	2.407	**19.350**	5.926	2.573	15.278	1.000	46.533
Panino 🥉	1.273	15.599	7.106	11.935	3.445	2.623	41.981
PATTY$_B$	1.604	3.683	11.680	7.643	12.446	2.999	40.055
PATTY$_G$	1.010	4.200	11.946	8.097	12.148	2.453	39.853
PATTYINT	1.815	5.219	**14.728**	13.479	2.362	0.000	37.604
nplanning-agl-1	2.372	12.949	6.774	3.143	3.596	0.724	29.558
Tyr-agl-ground	**5.543**	14.860	6.942	1.712	0.090	0.135	29.284
ENHSP SoCS 2024 M($3h$||$3n$)	2.442	12.343	8.529	5.535	0.000	0.384	29.232
nplanning-agl-2	2.313	13.892	6.895	2.725	3.030	0.177	29.032
TamerLite-agl-2	2.743	5.810	3.627	2.142	0.000	1.114	15.436
TamerLite-agl-1	1.457	0.549	4.350	7.003	0.029	1.156	14.545
Tyr-agl-lifted	0.042	0.386	2.989	1.000	0.000	0.816	5.233

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Winner

Count Downward-sat

Total score: **77.007/120**

Authors:

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Satisficing Track

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Count Downward-sat 🥇	3.332	16.012	9.653	15.222	**19.892**	**12.895**	77.007
Panino-anytime 🥈	2.156	15.951	13.868	**18.451**	3.702	8.701	62.829
$\text{PATTY}^{\text{C}}_{\text{B}}$ 🥉	3.816	9.047	**20.000**	10.471	7.790	6.217	57.341
$\text{PATTY}^{\text{C}}_{\text{G}}$	1.816	10.233	18.802	12.807	7.380	4.298	55.336
ENHSP ICAPS 2025 -anytime	1.962	11.205	8.303	15.385	10.142	3.041	50.038
TamerLite-sat-2	4.736	12.605	11.591	13.000	5.000	2.963	49.894
Tyr-sat-ground	**7.321**	**17.765**	13.277	2.000	2.000	0.875	43.237
nplanning-sat-2	2.961	16.463	9.809	5.742	5.000	2.000	41.975
TamerLite-sat-1	4.760	11.635	11.597	4.000	5.000	3.963	40.956
ENHSP SoCS 2024 M$(3h\|\|3n)$	2.842	10.996	12.701	11.261	0.000	0.966	38.765
PlanForge-sat	1.335	10.323	5.129	2.671	16.360	1.000	36.820
nplanning-sat-1	0.685	10.938	8.228	5.774	3.202	2.000	30.827
Tempest	5.000	1.473	4.078	1.833	16.822	1.000	30.207
Tyr-sat-lifted	0.731	0.992	3.541	0.833	0.750	1.000	7.847

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Winner

Count Downward Together-opt-2

Total coverage: **45/120**

Authors:

Daniel Gnad, Markus Fritzsche, Mikhail Gruntov, Alexander Shleyfman

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SNP Coverage Rank

Optimal Track

Planner	expedition	forestfire	line-ex.-snp	onlycraft-opt	petri-net	settlers-snp	Σ
Count Downward Together-opt-2	**6**	**11**	**7**	**6**	**15**	0	45
Count Downward Together-opt-1	**6**	**11**	**7**	2	9	0	35
PlanForge-opt-2	**6**	**11**	5	3	10	0	35
Count Downward-opt-1	**6**	10	**7**	2	9	0	34
Count Downward-opt-2	**6**	**11**	5	2	9	0	33
PlanForge-opt-1	5	**11**	4	2	9	0	31
$A^\star(h^{hrmax})$	5	**11**	5	2	3	0	26
Tyr-opt-ground	**6**	9	6	2	3	0	26
Tyr-opt-lift	5	6	4	2	3	0	20
$A^\star(h^{blind})$	5	7	3	2	2	0	19

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Closing Remarks

Numeric Planning is gaining traction!

- IPC 2023: two teams
- Now: 10 teams! (doubled the expectation)

Discussion:

- What fragments should we focus on?
- What could we do to improve the organisation?

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