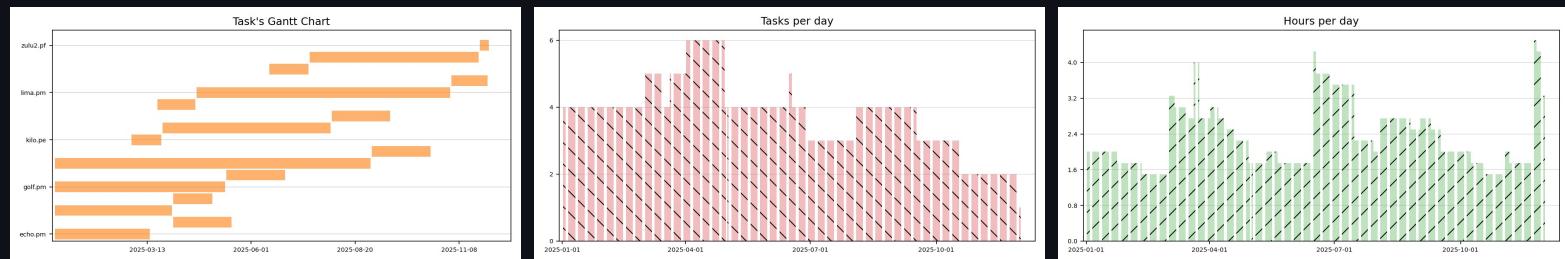


Yumbo. Scheduling, Planning and Resource Allocation

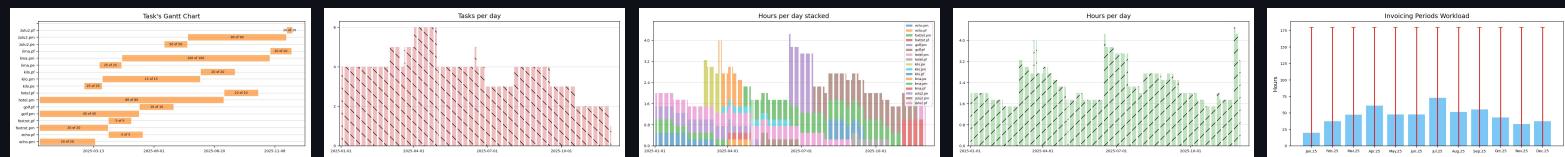
Zbigniew Romanowski, Paweł Koczyk

28 January 2025, 13:53:32 PM

Experts overview



PM.Lisa the 1st unit



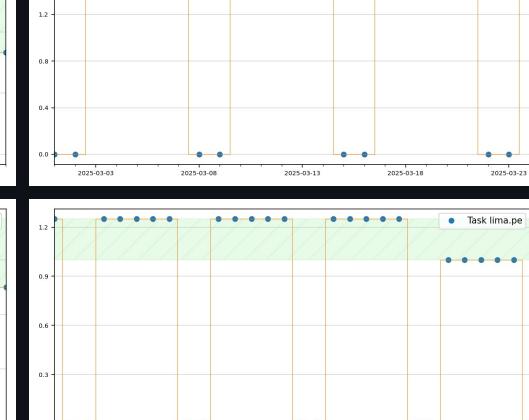
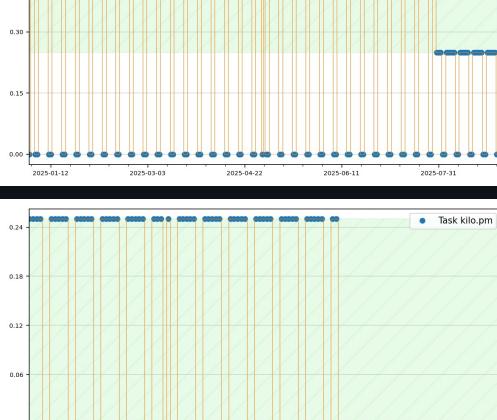
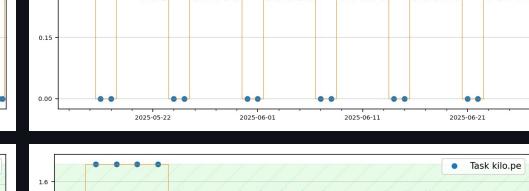
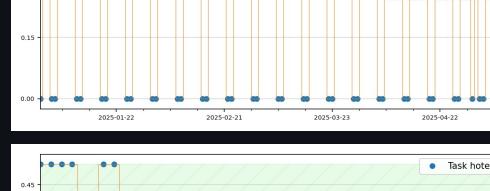
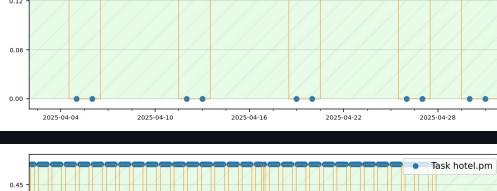
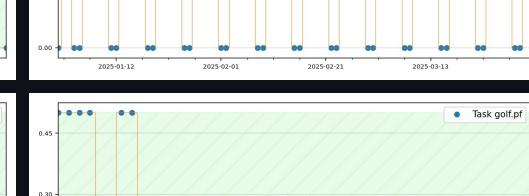
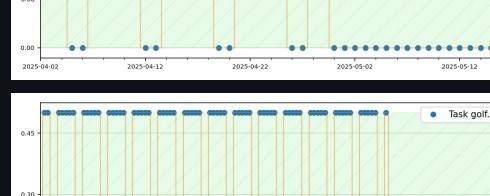
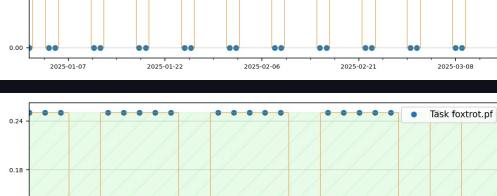
	Weekdays	echo.p.m	echo.p.f	foxtrot.p.m	foxtrot.p.f	golf.p.m	golf.p.f	hotel.p.m	hotel.p.f	kilo.pe	kilo.p.m	kilo.pf	lima.pe	lima.p.m	lima.pf	zulu2.pe	zulu2.p.m	zulu2.pf
2025-02-12	Wednesday	0.25		0.25		0.50		0.50										
2025-02-13	Thursday	0.25		0.25		0.50		0.50										
2025-02-14	Friday	0.25		0.25		0.50		0.50										
2025-02-15	Saturday																	
2025-02-16	Sunday																	
2025-02-17	Monday	0.25		0.25		0.50		0.50										
2025-02-18	Tuesday	0.25		0.25		0.50		0.50										
2025-02-19	Wednesday	0.25		0.25		0.50		0.50										
2025-02-20	Thursday	0.25		0.25		0.50		0.50										
2025-02-21	Friday	0.25		0.25		0.50		0.50										
2025-02-22	Saturday																	
2025-02-23	Sunday																	
2025-02-24	Monday	0.25		0.25		0.50		0.50										
2025-02-25	Tuesday	0.25		0.25		0.50		0.50										
2025-02-26	Wednesday	0.25		0.25		0.50		0.50										
2025-02-27	Thursday	0.25		0.25		0.50		0.50										
2025-02-28	Friday	0.25		0.25		0.50		0.50										
2025-03-01	Saturday																	
2025-03-02	Sunday																	
2025-03-03	Monday	0.25		0.25		0.50		0.50		1.75								
2025-03-04	Tuesday	0.25		0.25		0.50		0.50		1.75								
2025-03-05	Wednesday	0.25		0.25		0.50		0.50		1.75								
2025-03-06	Thursday	0.25		0.25		0.50		0.50		1.75								
2025-03-07	Friday	0.25		0.25		0.50		0.50		1.50								
2025-03-08	Saturday																	
2025-03-09	Sunday																	
2025-03-10	Monday	0.25		0.25		0.50		0.50		1.50								
2025-03-11	Tuesday	0.25		0.25		0.50		0.50		1.50								
2025-03-12	Wednesday	0.25		0.25		0.50		0.50		1.50								
2025-03-13	Thursday	0.25		0.25		0.50		0.50		1.50								
2025-03-14	Friday	0.25		0.25		0.50		0.50		1.50								
2025-03-15	Saturday																	
2025-03-16	Sunday																	
2025-03-17	Monday			0.25		0.50		0.50		1.50								
2025-03-18	Tuesday			0.25		0.50		0.50		1.50								
2025-03-19	Wednesday			0.25		0.50		0.50		1.50								
2025-03-20	Thursday			0.25		0.50		0.50		1.50								
2025-03-21	Friday			0.25		0.50		0.50		1.50			1.25					
2025-03-22	Saturday																	
2025-03-23	Sunday																	
2025-03-24	Monday			0.25		0.50		0.50		1.50			1.25					
2025-03-25	Tuesday			0.25		0.50		0.50		0.25			1.25					
2025-03-26	Wednesday			0.25		0.50		0.50		0.25			1.25					
2025-03-27	Thursday			0.25		0.50		0.50		0.25			1.25					
2025-03-28	Friday			0.25		0.50		0.50		0.25			1.25					
2025-03-29	Saturday																	
2025-03-30	Sunday																	
2025-03-31	Monday			0.25		0.50		0.50		0.25			1.25					
2025-04-01	Tuesday			0.25		0.50		0.50		0.25			1.25					
2025-04-02	Wednesday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-03	Thursday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-04	Friday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-05	Saturday																	
2025-04-06	Sunday																	
2025-04-07	Monday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-08	Tuesday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-09	Wednesday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-10	Thursday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-11	Friday	0.25		0.25	0.50	0.50		0.50		0.25			1.25					
2025-04-12	Saturday																	
2025-04-13	Sunday																	
2025-04-14	Monday	0.25		0.25	0.50	0.50		0.50		0.25			1.00					
2025-04-15	Tuesday	0.25		0.25	0.50	0.50		0.50		0.25			1.00					
2025-04-16	Wednesday	0.25		0.25	0.50	0.50		0.50		0.25			1.00					
2025-04-17	Thursday	0.25		0.25	0.50	0.50		0.50		0.25			1.00					

	Weekdays	echo.p.m	echo.p.f	foxtrot.p.m	foxtrot.p.f	golf.p.m	golf.p.f	hotel.p.m	hotel.p.f	kilo.p.e	kilo.p.m	kilo.p.f	lima.p.e	lima.p.m	lima.p.f	zulu2.p.e	zulu2.p.m	zulu2.p.f
2025-06-22	Sunday																	
2025-06-23	Monday						0.25	0.50						0.75		2.25		
2025-06-24	Tuesday						0.25	0.50						0.75		2.25		
2025-06-25	Wednesday						0.25	0.50						0.75		2.25		
2025-06-26	Thursday						0.25	0.50						0.75		2.25		
2025-06-27	Friday						0.25	0.50						0.75		2.25		
2025-06-28	Saturday																	
2025-06-29	Sunday																	
2025-06-30	Monday							0.50						0.75		2.25		
2025-07-01	Tuesday							0.50						0.75		2.25		
2025-07-02	Wednesday							0.50						0.75		2.25		
2025-07-03	Thursday							0.50						0.75		2.25		
2025-07-04	Friday							0.50						0.75		2.25		
2025-07-05	Saturday																	
2025-07-06	Sunday																	
2025-07-07	Monday							0.50						0.75		2.25		
2025-07-08	Tuesday							0.50						0.75		2.25		
2025-07-09	Wednesday							0.50						0.75		2.25		
2025-07-10	Thursday							0.50						0.75		2.25		
2025-07-11	Friday							0.50						0.75		2.25		
2025-07-12	Saturday																	
2025-07-13	Sunday																	
2025-07-14	Monday							0.50						0.75		2.25		
2025-07-15	Tuesday							0.50						0.75		2.25		
2025-07-16	Wednesday							0.50						0.75		1.00		
2025-07-17	Thursday							0.50						0.75		1.00		
2025-07-18	Friday							0.50						0.75		1.00		
2025-07-19	Saturday																	
2025-07-20	Sunday																	
2025-07-21	Monday							0.50						0.75		1.00		
2025-07-22	Tuesday							0.50						0.75		1.00		
2025-07-23	Wednesday							0.50						0.75		1.00		
2025-07-24	Thursday							0.50						0.75		1.00		
2025-07-25	Friday							0.50						0.75		1.00		
2025-07-26	Saturday																	
2025-07-27	Sunday																	
2025-07-28	Monday							0.50						0.75		1.00		
2025-07-29	Tuesday							0.50						0.75		1.00		
2025-07-30	Wednesday							0.25						0.75		1.00		
2025-07-31	Thursday							0.25						0.75		1.00		
2025-08-01	Friday							0.25						0.75		1.00		
2025-08-02	Saturday																	
2025-08-03	Sunday																	
2025-08-04	Monday							0.25						0.75		1.00		
2025-08-05	Tuesday							0.25						0.75		1.00		
2025-08-06	Wednesday							0.25						0.75		1.00		
2025-08-07	Thursday							0.25						0.75		1.00		
2025-08-08	Friday							0.25						0.75		1.00		
2025-08-09	Saturday																	
2025-08-10	Sunday																	
2025-08-11	Monday							0.25						0.75		1.00		
2025-08-12	Tuesday							0.25						0.75		1.00		
2025-08-13	Wednesday							0.25						0.75		1.00		
2025-08-14	Thursday							0.25						0.75		1.00		
2025-08-15	Friday							0.25						0.75		1.00		
2025-08-16	Saturday																	
2025-08-17	Sunday																	
2025-08-18	Monday							0.25						0.75		1.00		
2025-08-19	Tuesday							0.25						0.75		1.00		
2025-08-20	Wednesday							0.25						0.75		1.00		
2025-08-21	Thursday							0.25						0.75		1.00		
2025-08-22	Friday							0.25						0.75		1.00		
2025-08-23	Saturday																	
2025-08-24	Sunday																	
2025-08-25	Monday							0.25						0.75		1.00		

	Weekdays	echo.p.m	echo.p.f	foxtrot.p.m	foxtrot.p.f	golf.p.m	golf.p.f	hotel.p.m	hotel.p.f	kilo.pe	kilo.p.m	kilo.pf	lima.pe	lima.p.m	lima.p.f	zulu2.pe	zulu2.p.m	zulu2.pf
2025-08-26	Tuesday							0.25				0.50		0.75			1.00	
2025-08-27	Wednesday							0.25				0.50		0.75			1.00	
2025-08-28	Thursday							0.25				0.50		0.75			1.00	
2025-08-29	Friday							0.25				0.50		0.75			1.00	
2025-08-30	Saturday																	
2025-08-31	Sunday																	
2025-09-01	Monday							0.25				0.50		0.75			1.00	
2025-09-02	Tuesday								0.50			0.50		0.75			1.00	
2025-09-03	Wednesday								0.50			0.50		0.75			1.00	
2025-09-04	Thursday								0.50			0.50		0.75			1.00	
2025-09-05	Friday								0.50			0.50		0.75			1.00	
2025-09-06	Saturday																	
2025-09-07	Sunday																	
2025-09-08	Monday								0.50			0.50		0.75			1.00	
2025-09-09	Tuesday								0.50			0.50		0.75			1.00	
2025-09-10	Wednesday								0.25			0.50		0.75			1.00	
2025-09-11	Thursday								0.25			0.50		0.75			1.00	
2025-09-12	Friday								0.25			0.50		0.75			1.00	
2025-09-13	Saturday																	
2025-09-14	Sunday																	
2025-09-15	Monday							0.25			0.50		0.75			1.00		
2025-09-16	Tuesday								0.25			0.50		0.75			1.00	
2025-09-17	Wednesday								0.25					0.75			1.00	
2025-09-18	Thursday								0.25					0.75			1.00	
2025-09-19	Friday								0.25					0.75			1.00	
2025-09-20	Saturday																	
2025-09-21	Sunday																	
2025-09-22	Monday								0.25					0.75			1.00	
2025-09-23	Tuesday								0.25					0.75			1.00	
2025-09-24	Wednesday								0.25					0.75			1.00	
2025-09-25	Thursday								0.25					0.75			1.00	
2025-09-26	Friday								0.25					0.75			1.00	
2025-09-27	Saturday																	
2025-09-28	Sunday																	
2025-09-29	Monday								0.25					0.75			1.00	
2025-09-30	Tuesday								0.25					0.75			1.00	
2025-10-01	Wednesday								0.25					0.75			1.00	
2025-10-02	Thursday								0.25					0.75			1.00	
2025-10-03	Friday								0.25					0.75			1.00	
2025-10-04	Saturday																	
2025-10-05	Sunday																	
2025-10-06	Monday								0.25					0.75			1.00	
2025-10-07	Tuesday								0.25					0.75			1.00	
2025-10-08	Wednesday								0.25					0.75			1.00	
2025-10-09	Thursday								0.25					0.50			1.00	
2025-10-10	Friday								0.25					0.50			1.00	
2025-10-11	Saturday																	
2025-10-12	Sunday																	
2025-10-13	Monday								0.25					0.50			1.00	
2025-10-14	Tuesday								0.25					0.50			1.00	
2025-10-15	Wednesday								0.25					0.50			1.00	
2025-10-16	Thursday								0.25					0.50			1.00	
2025-10-17	Friday								0.25					0.50			1.00	
2025-10-18	Saturday																	
2025-10-19	Sunday																	
2025-10-20	Monday													0.50			1.00	
2025-10-21	Tuesday													0.50			1.00	
2025-10-22	Wednesday													0.50			1.00	
2025-10-23	Thursday													0.50			1.00	
2025-10-24	Friday													0.50			1.00	
2025-10-25	Saturday																	
2025-10-26	Sunday																	
2025-10-27	Monday													0.50			1.00	
2025-10-28	Tuesday													0.50			1.00	
2025-10-29	Wednesday													0.50			1.00	

	Weekdays	echo.p.m	echo.p.f	foxtrot.p.m	foxtrot.p.f	golf.p.m	golf.p.f	hotel.p.m	hotel.p.f	kilo.p.e	kilo.p.m	kilo.p.f	lima.p.e	lima.p.m	lima.p.f	zulu2.p.e	zulu2.p.m	zulu2.p.f
2025-10-30	Thursday													0.50			1.00	
2025-10-31	Friday													0.50			1.00	
2025-11-01	Saturday																	
2025-11-02	Sunday																	
2025-11-03	Monday													1.00			1.00	
2025-11-04	Tuesday													1.00			1.00	
2025-11-05	Wednesday													1.00			1.00	
2025-11-06	Thursday													1.00			0.75	
2025-11-07	Friday													1.00			0.75	
2025-11-08	Saturday																	
2025-11-09	Sunday																	
2025-11-10	Monday													1.00			0.75	
2025-11-11	Tuesday													1.00			0.75	
2025-11-12	Wednesday													1.00			0.75	
2025-11-13	Thursday													1.00			0.75	
2025-11-14	Friday													1.00			0.75	
2025-11-15	Saturday																	
2025-11-16	Sunday																	
2025-11-17	Monday													1.00			0.75	
2025-11-18	Tuesday													1.00			0.75	
2025-11-19	Wednesday													1.00			0.75	
2025-11-20	Thursday													1.00			0.75	
2025-11-21	Friday													1.00			0.75	
2025-11-22	Saturday																	
2025-11-23	Sunday																	
2025-11-24	Monday													1.00			3.50	
2025-11-25	Tuesday													1.00			3.50	
2025-11-26	Wednesday													1.00			3.25	
2025-11-27	Thursday													1.00			3.25	
2025-11-28	Friday													1.00			3.25	
2025-11-29	Saturday																	
2025-11-30	Sunday																	
2025-12-01	Monday																	3.25

Show schedule as Streamlit table





Solver output at 28 January 2025, 13:53:24 PM

```

HiGHS 1.8.1: tech:outlev = 1
Running HiGHS 1.8.1 (git hash: 4a7f24a): Copyright (c) 2024 HiGHS under MIT licence terms
Coefficient ranges:
Matrix [1e+00, 3e+01]
Cost [1e+00, 1e+00]
Bound [1e+00, 2e+02]
RHS [2e+01, 4e+02]
Presolving model
310 rows, 1071 cols, 1512 nonzeros 0s
16 rows, 924 cols, 924 nonzeros 0s
16 rows, 924 cols, 924 nonzeros 0s

```

```

Solving MIP model with:
16 rows
924 cols (147 binary, 777 integer, 0 implied int., 0 continuous)
924 nonzeros

```

```
MIP-Timing: 0.0052 - starting analytic centre calculation
```

```

Src: B => Branching; C => Central rounding; F => Feasibility pump; H => Heuristic; L => Sub-MIP;
P => Empty MIP; R => Randomized rounding; S => Solve LP; T => Evaluate node; U => Unbounded;
z => Trivial zero; l => Trivial lower; u => Trivial upper; p => Trivial point

```

Src	Proc.	Nodes		B&B Tree		Objective		Bounds		Dynamic		Constraints		Work		Time
		In Queue	Leaves	Expl.	BestBound	BestSol	Gap	Cuts	InLP	Confl.	LpIters					
T	0	0	0	0.00%	5289.450942	inf	inf	0	0	0	0	0	0	0	0.0s	
	1	0	1	100.00%	5289.450942	7466.337275	29.16%	0	0	0	16	0	0	0	0.0s	
					7466.337275	7466.337275	0.00%	0	0	0	16	0	0	0	0.0s	

Solving report

```

Status          Optimal
Primal bound   7466.33727478
Dual bound     7466.33727478
Gap            0% (tolerance: 0.01%)
P-D integral   6.95133549264e-06
Solution status feasible
7466.33727478 (objective)
0 (bound viol.)
0 (int. viol.)
0 (row viol.)
Timing         0.01 (total)
0.00 (presolve)
0.00 (solve)
0.00 (postsolve)

```

```

Max sub-MIP depth 0
Nodes          1
Repair LPs     0 (0 feasible; 0 iterations)
LP iterations   16 (total)
0 (strong br.)
0 (separation)
0 (heuristics)

```

```
HiGHS 1.8.1: optimal solution; objective 7466.337275
```

```
16 simplex iterations
```

```
1 branching nodes
```

```
"option abs_boundtol 2.842170943040401e-14;"  
or "option rel_boundtol 1.5786024397762919e-16;"  
will change deduced dual values.
```

Elapsed time for chart creation

Chart title	Chart short name	Number of calls	Elapsed time [s]	Average time per chart [s]
Hours per day stacked	simg	1	2.918	2.918
Plot task with its constrains	bimg	17	2.065	0.121
Tasks per day	timg	1	0.294	0.294
Hours per day	himg	1	0.291	0.291
Task's Gannt Chart	gimg	1	0.157	0.157
Invoicing Periods Workload	wimg	1	0.113	0.113

