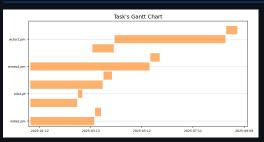
Yumbo. Scheduling, Planning and Resource Allocation

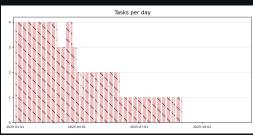
Zbigniew Romanowski, Paweł Koczyk

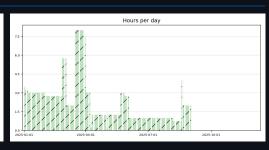
Source code, documentation and sample Excel input files can be found on Yumbo's GitHub repository

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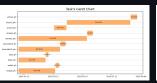
Experts overview

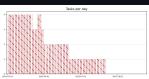


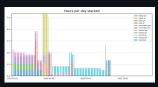


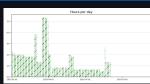


PM.Fabian the 2nd unit











	Weekdays	india2.pm	india2.pf	kilo2.pm	kilo2.pf	november2.pm	november2.pf	romeo2.pm	romeo2.pf	victor2.pe	victor2.pm	victor2.pf
2025-01-01	Wednesday											
2025-01-02	Thursday	1.00		1.00		1.00		0.50				
2025-01-03	Friday	0.75		1.00		1.00		0.50				
2025-01-04	Saturday											
2025-01-05	Sunday											
2025-01-06	Monday	0.75		1.00		1.00		0.50				
2025-01-07	Tuesday	0.75		0.75		1.00		0.50				
2025-01-08	Wednesday	0.75		0.75		1.00		0.50				
2025-01-09	Thursday	0.75		0.75		1.00		0.50				
2025-01-10	Friday	0.75		0.75		1.00		0.50				
2025-01-11	Saturday											
2025-01-12	Sunday											
2025-01-13	Monday	0.75		0.75		1.00		0.50				
2025-01-14	Tuesday	0.75		0.75		1.00		0.50				
2025-01-15	Wednesday	0.75		0.75		1.00		0.50				
2025-01-16	Thursday	0.75		0.75		1.00		0.50				
2025-01-17	Friday	0.75		0.75		1.00		0.50				
2025-01-18	Saturday											
2025-01-19	Sunday											
2025-01-20	Monday	0.75		0.75		1.00		0.50				
2025-01-21	Tuesday	0.75		0.75		1.00		0.50				
2025-01-22	Wednesday	0.75		0.75		1.00		0.50				
2025-01-23	Thursday	0.75		0.75		1.00		0.50				
2025-01-24	Friday	0.75		0.75		1.00		0.50				
2025-01-25	Saturday											
2025-01-26	Sunday											
2025-01-27	Monday	0.75		0.75		1.00		0.50				
2025-01-28	Tuesday	0.75		0.75		1.00		0.50				
2025-01-29	Wednesday	0.75		0.75		1.00		0.50				
2025-01-30	Thursday	0.75		0.75		1.00		0.50				
2025-01-31	Friday	0.75		0.75		1.00		0.25				
2025-02-01	Saturday											
2025-02-02	Sunday											
2025-02-03	Monday	0.75		0.75		1.00		0.25				
2025-02-04	Tuesday	0.75		0.75		1.00		0.25				
2025-02-05	Wednesday	0.75		0.75		1.00		0.25				
2025-02-06	Thursday	0.75		0.75		1.00		0.25				
2025-02-07	Friday	0.75		0.75		1.00		0.25				
2025-02-08	Saturday											
2025-02-09	Sunday											
2025-02-10	Monday	0.75		0.75		1.00		0.25				
2025-02-11	Tuesday	0.75		0.75		1.00		0.25				

	Weekdays	india2.pm	india2.pf	kilo2.pm	kilo2.pf	november2.pm	november2.pf	romeo2.pm	romeo2.pf	victor2.pe	victor2.pm	victor2.pf
2025-02-12	Wednesday	0.75		0.75		1.00		0.25				
2025-02-13	Thursday	0.75		0.75		1.00		0.25				
2025-02-14	Friday	0.75		0.75		1.00		0.25				
2025-02-15	Saturday											
2025-02-16	Sunday	0.75		0.75		1.00		0.25				
2025-02-18	Tuesday	0.75		0.75		1.00		0.25				
2025-02-19	Wednesday	0.75		0.75		1.00		0.25				
2025-02-20	Thursday	0.75		0.75		1.00		0.25				
2025-02-21	Friday	0.75		0.75		1.00		0.25				
2025-02-22	Saturday Sunday											
2025-02-24	Monday	0.75		0.75		1.00		0.25				
2025-02-25	Tuesday	0.75		0.75		1.00		0.25				
2025-02-26	Wednesday	0.75			3.75	1.00		0.25				
2025-02-27	Thursday	0.75			3.75	1.00		0.25				
2025-02-28	Friday Saturday	0.75			3.75	1.00		0.25				
2025-03-02	Sunday											
2025-03-03	Monday	0.75			3.75	1.00		0.25				
2025-03-04	Tuesday	0.75				1.00		0.25				
2025-03-05	Wednesday	0.75				1.00		0.25				
2025-03-06	Thursday Friday	0.75				1.00		0.25				
2025-03-08	Saturday											
2025-03-09	Sunday											
2025-03-10	Monday	0.75				1.00		0.25				
2025-03-11	Tuesday	0.75				1.00		0.25				
2025-03-12	Wednesday Thursday	0.75 0.75				1.00		0.25				
2025-03-13	Friday	0.75				1.00		0.25				
2025-03-15	Saturday											
2025-03-16	Sunday											
2025-03-17	Monday	0.75				0.75		0.25		6.25		
2025-03-18	Tuesday		1.75			0.75		0.25		5.25		
2025-03-19	Wednesday Thursday		1.75			0.75		0.25		5.25 5.25		
2025-03-21	Friday		1.75			1.00		0.25		5.00		
2025-03-22	Saturday											
2025-03-23	Sunday											
2025-03-24	Monday		1.50			1.00		0.25		5.25		
2025-03-25	Tuesday Wednesday		1.50			1.00		0.25		5.25 6.75		
2025-03-27	Thursday					1.00		0.25		6.75		
2025-03-28	Friday						3.00	0.25		4.75		
2025-03-29	Saturday											
2025-03-30	Sunday											
2025-03-31	Monday Tuesday						3.00	0.25		4.25		
2025-04-01	Wednesday						2.75	0.25				
2025-04-03	Thursday						2.75	0.25				
2025-04-04	Friday						2.75	0.25				
2025-04-05	Saturday											
2025-04-06	Sunday											
2025-04-07	Monday Tuesday						2.75	0.25				
2025-04-09	Wednesday							0.25				
2025-04-10	Thursday							0.25			1.00	
2025-04-11	Friday							0.25			1.00	
2025-04-12	Saturday											
2025-04-13	Sunday Monday							0.25			1.00	
2025-04-14	мопаау Tuesday							0.25			1.00	
2025-04-16	Wednesday							0.25			1.00	
2025-04-17	Thursday							0.25			1.00	

Mathematical		Weekdays	india2.pm	india2.pf	kilo2.pm	kilo2.pf	november2.pm	november2.pf	romeo2.pm	romeo2.pf	victor2.pe	victor2.pm	victor2.pf
Same to the color of the col	2025-04-18	Friday							0.25			1.00	
Simple Market	2025-04-19	Saturday											
MathewayName of State of Teach o	2025-04-20	Sunday											
Decompose of the color of th	2025-04-21	Monday							0.25			1.00	
Mathematical MethodsM	2025-04-22	Tuesday							0.25			1.00	
Simple Company Company <th< th=""><th>2025-04-23</th><th>Wednesday</th><th></th><th></th><th></th><th></th><th></th><th></th><th>0.25</th><th></th><th></th><th>1.00</th><th></th></th<>	2025-04-23	Wednesday							0.25			1.00	
Declar of Series	2025-04-24	Thursday							0.25			1.00	
	2025-04-25	Friday							0.25			1.00	
	2025-04-26	Saturday											
NameProcess111	2025-04-27	Sunday											
Note													
Mathematical Professor P													
Note									0.25			1.00	
State of the State of									0.25			1.00	
									0.23			1.00	
Name													
									0.25			1.00	
Marches Transfer Control Con	2025-05-06												
	2025-05-07	Wednesday							0.25			1.00	
	2025-05-08	Thursday							0.25			1.00	
	2025-05-09	Friday							0.25			1.00	
	2025-05-10	Saturday											
2025-95-13 Unexholy Image: Control of the control of t	2025-05-11	Sunday											
2021-09-14 Wellendolly Involute	2025-05-12	Monday							0.25			1.00	
2015-05-15 Thinking Montal of the law of t	2025-05-13	Tuesday							0.25			1.00	
2015-01-16 Prifiting	2025-05-14	Wednesday											
2015-05-17 Salturday Image: Control of Salturday													
									0.25			1.00	
2025-6-19 Monday Image: Control of the State of the													
2025-65-20 Vedendry 1026-67-20 Vednesdry 1026-67-20									0.25			1.00	
2025-65-21 Munday													
2023-06-12 Thurday 1.00 1.													
2025-05-23 Friday Image: Control of the									0.23	2.00			
2025-05-24 Saturday Image: Company of the company of t													
2025-05-26 Monday Mon													
2025-05-27 Tuesday Use of the state of	2025-05-25	Sunday											
2023-05-28 Wednesday Inusday 1.75 1.00 2023-05-29 Thursday 1.75 1.00 1.75 1.00 2023-05-30 Friday 1.75 1.00 1.75 1.00 1.00 2023-06-01 Sunday 1.75 1.00 1.75 1.00	2025-05-26	Monday								2.00		1.00	
2025-05-39 Thunday	2025-05-27	Tuesday								2.00		1.00	
2025-96-30 Friday	2025-05-28	Wednesday								1.75		1.00	
2025-06-01 Sunday	2025-05-29	Thursday								1.75		1.00	
2025-06-02 Sunday Monday Mon	2025-05-30									1.75		1.00	
2025-06-02 Monday Image: Control of the state of the	2025-05-31	Saturday											
2025-06-03 Tuesday 1.00 1.00 2025-06-04 Wednesday 1.00 1.00 2025-06-05 Thursday 1.00 1.00 2025-06-06 Friday 1.00 1.00 2025-06-07 Saturday 1.00 1.00 2025-06-08 Sunday 1.00 1.00 2025-06-10 Tuesday 1.00 1.00 2025-06-11 Wednesday 1.00 1.00 2025-06-12 Thursday 1.00 1.00 2025-06-13 Friday 1.00 1.00 2025-06-14 Saturday 1.00 1.00 2025-06-15 Sunday 1.00 1.00 2025-06-16 Monday 1.00 1.00 2025-06-18 Wednesday 1.00 1.00 2025-06-19 Thursday 1.00 1.00 2025-06-19 Thursday 1.00 1.00 2025-06-19 Wednesday 1.00 1.00 2025-06-19 Thursday													
2025-06-08 Wednesday Image: Control of the state of										1.75			
2025-06-05 Thursday 100													
2025-06-06 Friday 1.00 1.00 2025-06-07 Saturday 1.00 1.00 2025-06-08 Sunday 1.00 1.00 2025-06-09 Monday 1.00 1.00 2025-06-10 Tuesday 1.00 1.00 2025-06-11 Wednesday 1.00 1.00 2025-06-12 Thursday 1.00 1.00 2025-06-13 Friday 1.00 1.00 2025-06-14 Saturday 1.00 1.00 2025-06-15 Sunday 1.00 1.00 2025-06-16 Monday 1.00 1.00 2025-06-17 Tuesday 1.00 1.00 2025-06-18 Wednesday 1.00 1.00 2025-06-19 Thursday 1.00 1.00 2025-06-19 Thursday 1.00 1.00 2025-06-19 Friday 1.00 1.00													
2025-06-07 Saturday													
2025-06-08 Sunday Monday 1.00												1.00	
2025-06-09 Monday													
2025-06-10 Tuesday 1.00 2025-06-11 Wednesday 1.00 2025-06-12 Thursday 1.00 2025-06-13 Friday 1.00 2025-06-14 Saturday 1.00 2025-06-15 Sunday 1.00 2025-06-16 Monday 1.00 2025-06-17 Tuesday 1.00 2025-06-18 Wednesday 1.00 2025-06-19 Thursday 1.00 2025-06-20 Friday 1.00												1.00	
2025-06-11 Wednesday 1.00 2025-06-12 Thursday 1.00 2025-06-13 Friday 1.00 2025-06-14 Saturday 1.00 2025-06-15 Sunday 1.00 2025-06-16 Monday 1.00 2025-06-17 Tuesday 1.00 2025-06-18 Wednesday 1.00 2025-06-19 Thursday 1.00 2025-06-20 Friday 1.00													
2025-06-12 Thursday 1.00 2025-06-13 Friday 1.00 2025-06-14 Saturday													
2025-06-14 Saturday <													
2025-06-15 Sunday Sunday 1.00 2025-06-16 Monday 1.00 1.00 2025-06-17 Tuesday 1.00 1.00 2025-06-18 Wednesday 1.00 1.00 2025-06-19 Thursday 1.00 1.00 2025-06-20 Friday 1.00 1.00	2025-06-13											1.00	
2025-06-16 Monday 1.00 2025-06-17 Tuesday 1.00 2025-06-18 Wednesday 1.00 2025-06-19 Thursday 1.00 2025-06-20 Friday 1.00	2025-06-14	Saturday											
2025-06-17 Tuesday 1.00 2025-06-18 Wednesday 1.00 2025-06-19 Thursday 1.00 2025-06-20 Friday 1.00	2025-06-15	Sunday											
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2025-06-19 Thursday 2025-06-20 Friday 1.00	2025-06-17	Tuesday										1.00	
2025-06-20 Friday 1.00	2025-06-18	Wednesday										1.00	
	2025-06-19	Thursday										1.00	
2025-06-21 Saturday Saturday	2025-06-20	Friday										1.00	
	2025-06-21	Saturday											

	Weekdays	india2.pm	india2.pf	kilo2.pm	kilo2.pf	november2.pm	november2.pf	romeo2.pm	romeo2.pf	victor2.pe	victor2.pm	victor2.pf
2025-06-22	Sunday											
2025-06-23	Monday										1.00	
2025-06-24	Tuesday										1.00	
2025-06-25	Wednesday										1.00	
2025-06-26	Thursday										1.00	
2025-06-27	Friday										1.00	
2025-06-28	Saturday											
2025-06-29	Sunday											
2025-06-30	Monday										1.00	
2025-07-01	Tuesday										1.00	
2025-07-02	Wednesday										1.00	
2025-07-03	Thursday Friday										1.00	
2025-07-05	Saturday										1.00	
2025-07-06	Sunday											
2025-07-07	Monday										1.00	
2025-07-08	Tuesday										1.00	
2025-07-09	Wednesday										1.00	
2025-07-10	Thursday										1.00	
2025-07-11	Friday										1.00	
2025-07-12	Saturday											
2025-07-13	Sunday											
2025-07-14	Monday										1.00	
2025-07-15	Tuesday										1.00	
2025-07-16	Wednesday										1.00	
2025-07-17	Thursday										1.00	
2025-07-18	Friday										1.00	
2025-07-19	Saturday											
2025-07-20	Sunday										1.00	
2025-07-21	Tuesday										1.00	
2025-07-23	Wednesday										1.00	
2025-07-24	Thursday										1.00	
2025-07-25	Friday										1.00	
2025-07-26	Saturday											
2025-07-27	Sunday											
2025-07-28	Monday										1.00	
2025-07-29	Tuesday										1.00	
2025-07-30	Wednesday										1.00	
2025-07-31	Thursday										1.00	
2025-08-01	Friday										1.00	
2025-08-02	Saturday											
2025-08-03	Sunday											
2025-08-04	Monday										1.00	
2025-08-05	Tuesday Wednesday										1.00	
2025-08-07	Thursday										0.75	
2025-08-08	Friday										0.75	
2025-08-09	Saturday											
2025-08-10	Sunday											
2025-08-11	Monday										0.75	
2025-08-12	Tuesday										0.75	
2025-08-13	Wednesday										0.75	
2025-08-14	Thursday										0.75	
2025-08-15	Friday										0.75	
2025-08-16	Saturday											
2025-08-17	Sunday											
2025-08-18	Monday										0.75	
2025-08-19	Tuesday											4.00
2025-08-20	Wednesday											
2025-08-21	Thursday											2.00
2025-08-22	Friday											2.00
2025-08-23	Saturday											
2025-08-24	Sunday											2.00
2025-08-25	Monday											2.00



Show schedule as Streamlit table



Solver output at 28 January 2025, 13:58:08 PM

```
\label{eq:highs}  \mbox{HiGHS 1.8.1:} \quad \mbox{tech:outlev = 1} \\ \mbox{Running HiGHS } \mbox{1.8.1 (git hash: 4a7f24a): Copyright (c) 2024 HiGHS under MIT licence terms \\ \mbox{Temperature} \mbox{Tempe
           Matrix [1e+00, 3e+01]
Cost [1e+00, 1e+00]
Bound [1e+00, 6e+01]
RHS [3e+01, 4e+02]
Presolving model
68 rows, 413 cols, 532 nonzeros Os
66 rows, 351 cols, 468 nonzeros Os
                   66~\text{rows} 351 cols (60 binary, 291 integer, 0 implied int., 0 continuous)
MIP-Timing:
Src: B \Rightarrow Branching; C \Rightarrow Central rounding; F \Rightarrow Feasibility pump; H \Rightarrow Heuristic; L \Rightarrow Sub-MIP; P \Rightarrow Empty MIP; R \Rightarrow Randomized rounding; S \Rightarrow Solve LP; T \Rightarrow Evaluate node; U \Rightarrow Unbounded; z \Rightarrow Trivial zero; L \Rightarrow Trivial lower; u \Rightarrow Trivial upper; p \Rightarrow Trivial point
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  Dynamic Constraints Wo
Cuts InLp Confl. | LpIters
                                                                                                                                           B&B Tree
                                                                                                                                                                                                                                                                                                            Objective Bounds
                                                Nodes
         Status
Primal bound
                                                                                                                         Optimal
                                                                                                                      4339.79643874
4339.79643874
            Gap
P-D integral
                                                                                                                        0 (int. viol.)
0 (row viol.)
```

```
Timing 0.01 (total)
0.00 (presolve)
0.00 (solve)
0.00 (solve)
0.00 (postsolve)

Max sub-MIP depth 0
Nodes 1
Repair LPs 0 (0 feasible; 0 iterations)
LP iterations 45 (total)
0 (strong br.)
0 (separation)
0 (heuristics)

HiGHS 1.8.1: optimal solution; objective 4339.796439
45 simplex iterations
1 branching nodes
```

Elapsed time for chart creation

Hours per day stacked	simg	2.052	2.052
Plot task with its constrains	bimg	1.065	0.097
Tasks per day	timg	0.310	0.310
Hours per day	himg	0.293	0.293
Task's Gantt Chart	gimg	0.136	0.136
Invoicing Periods Workload	wimg	0.106	0.106