SCRUM-Based Software Development Optimization Model

Domain Modeling Engine

September 5, 2025

Contents

1 1. Sets (Entities) 2

2 2. Indices 3

3 3. Goals 3

4 4. Conditions 4

5 5. DecisionVariables 4

1. Sets (Entities)

$\mathcal{P}$: Set of Projects ($E0$)

$\mathcal{T}$: Set of Teams ($E1$)

$\mathcal{W}$: Set of Workers ($E2$)

$\mathcal{F}$: Set of Features ($E3$)

$\mathcal{S}$: Set of Skills ($E4$)

$\mathcal{R}$: Set of Roles ($E5$)

$\mathcal{PO}$: Set of Product Owners ($E6$)

$\mathcal{SM}$: Set of Scrum Masters ($E7$)

$\mathcal{PB}$: Set of Product Backlogs ($E8$)

$\mathcal{SP}$: Set of Sprints ($E9$)

$\mathcal{SPP}$: Set of Sprint Plannings ($E10$)

$\mathcal{DS}$: Set of Daily Scrums ($E11$)

$\mathcal{SR}$: Set of Sprint Reviews ($E12$)

$\mathcal{SRE}$: Set of Sprint Retrospectives ($E13$)

$\mathcal{SBL}$: Set of Sprint Backlogs ($E14$)

$\mathcal{SG}$: Set of Sprint Goals ($E15$)

$\mathcal{E}$: Set of Epics ($E16$)

$\mathcal{US}$: Set of User Stories ($E17$)

$\mathcal{TSK}$: Set of Tasks ($E18$)

$\mathcal{DEV}$: Set of Development Snapshots ($E19$)

$\mathcal{BL}$: Set of Blockers ($E20$)

$\mathcal{SH}$: Set of Stakeholders ($E21$)

$\mathcal{VEL}$: Set of Velocities ($E22$)

$\mathcal{REP}$: Set of Release Plans ($E23$)

$\mathcal{RM}$: Set of Roadmaps ($E24$)

$\mathcal{SCB}$: Set of Scrum Boards ($E25$)

$\mathcal{FED}$: Set of Feature Documentations ($E26$)

2. Indices

$p \in \mathcal{P}$: Index for projects

$t \in \mathcal{T}$: Index for teams

$w \in \mathcal{W}$: Index for workers

$f \in \mathcal{F}$: Index for features

$s \in \mathcal{S}$: Index for skills

$r \in \mathcal{R}$: Index for roles

$sp \in \mathcal{SP}$: Index for sprints

$us \in \mathcal{US}$: Index for user stories

$tk \in \mathcal{TSK}$: Index for tasks

$bl \in \mathcal{BL}$: Index for blockers

$sh \in \mathcal{SH}$: Index for stakeholders

$ep \in \mathcal{E}$: Index for epics

$vel \in \mathcal{VEL}$: Index for velocity records

$rep \in \mathcal{REP}$: Index for release plans

3. Goals

`maximize_team_productivity`: $\max \sum_{vel \in \mathcal{VEL}} \text{avg\_story\_points}_{vel} \times 1.5$

`minimize_project_duration`: $\min(\text{project\_end}_p - \text{project\_start}_p), \forall p \in \mathcal{P}$

`maximize_stakeholder_satisfaction`: $\max \sum_{sh \in \mathcal{SH}} \text{relevance\_to\_feature}_{sh} \times \text{influence\_level}_{sh} \times 1.3$

`minimize_task_effort_deviation`: $\min \sum_{tk \in \mathcal{TSK}} |\text{effort}_{tk}^{\text{actual}} - \text{effort}_{tk}^{\text{estimated}}| \times 1.1$

`maximize_feature_completion_rate`: $\max \sum_{f \in \mathcal{F}} I(\text{status}_f = \text{done}) \times 1.4$

`minimize_sprint_goal_failure`: $\min \sum_{sp \in \mathcal{SP}} I(\text{achievement\_status}_{sg(sp)} \neq \text{achieved}) \times 1.8$

`maximize_worker_utilization`: $\max \sum_{w \in \mathcal{W}} \text{availability}_w \times 1.2$

`minimize_blocker_resolution_time`: $\min \frac{1}{|\mathcal{BL}|} \sum_{bl \in \mathcal{BL}} (\text{resolved\_on}_{bl} - \text{detected\_on}_{bl}),$ if resolved

`maximize_documentation_coverage`: $\max \frac{|\{f \in \mathcal{F} | \exists fed \in \mathcal{FED}, fed.\text{linked\_requirements} \ni f\}|}{|\mathcal{F}|} \times 1.0$

`minimize_budget_overrun`: $\min \sum_{p \in \mathcal{P}} \max(0, \text{actual\_cost}_p - \text{budget}_p) \times 2.0$

`maximize_sprint_review_attendance`: $\max \frac{1}{|\mathcal{SR}|} \sum_{sr \in \mathcal{SR}} \text{attendees\_count}_{sr} \times 1.1$

`minimize_sprint_planning_duration`: $\min \frac{1}{|\mathcal{SPP}|} \sum_{spp \in \mathcal{SPP}} \text{duration\_(min)}_{spp} \times 1.0$

`maximize_development_snapshot_quality`: $\max \sum_{dev \in \mathcal{DEV}} I(\text{test\_status}_{dev} = \text{passed}) \times 1.3$

`minimize_epic_estimated_effort`: $\min \sum_{ep \in \mathcal{E}} \text{estimated\_effort}_{ep} \times 1.2$

4. Conditions

require_product_owner_assigned: $\forall p \in \mathcal{P}, \exists po \in \mathcal{PO} : \text{manages\_backlog}(po, pb(p))$

ensure_team_has_scrum_master: $\forall t \in \mathcal{T}, \exists sm \in \mathcal{SM} : \text{is\_supported\_by}(t, sm)$

enforce_sprint_duration_limit: $\forall sp \in \mathcal{SP}, (\text{end\_date}_{sp} - \text{start\_date}_{sp}) \leq 30$

limit_work_in_progress: $\sum_{tk \in \mathcal{TSK}} I(\text{status}_{tk} = \text{in\_progress}) \leq 5$

require_user_story_acceptance_criteria: $\forall us \in \mathcal{US}, \text{acceptance\_criteria}_{us} \neq \emptyset$

prevent_duplicate_worker_emails: $\forall w_1, w_2 \in \mathcal{W}, w_1 \neq w_2 \Rightarrow \text{email}_{w_1} \neq \text{email}_{w_2}$

enforce_task_belongs_to_story: $\forall tk \in \mathcal{TSK}, \exists us \in \mathcal{US} : \text{consists\_of\_tasks}(us, tk)$

ensure_feature_priority_defined: $\forall f \in \mathcal{F}, \text{priority}_f \in \{\text{low, medium, high, critical}\}$

require_sprint_goal_defined: $\forall sp \in \mathcal{SP}, \exists sg \in \mathcal{SG} : \text{pursues\_goal}(sp, sg) \wedge \text{objective\_description}_{sg} \neq \emptyset$

limit_worker_to_one_team: $\forall w \in \mathcal{W}, |\{t \in \mathcal{T} \mid \text{belongs\_to\_team}(w, t)\}| \leq 1$

enforce_unique_project_names: $\forall p_1, p_2 \in \mathcal{P}, p_1 \neq p_2 \Rightarrow \text{name}_{p_1} \neq \text{name}_{p_2}$

ensure_blocker_has_severity: $\forall bl \in \mathcal{BL}, \text{severity}_{bl} \in \{\text{low, medium, high, critical}\}$

require_velocity_calculation: $\forall t \in \mathcal{T}, \exists vel \in \mathcal{VEL} : \text{refers\_to\_team}(vel, t)$

prevent_future_sprint_overlap: $\forall sp_1, sp_2 \in \mathcal{SP}, sp_1 \neq sp_2 \Rightarrow [\text{start\_date}_{sp_1}, \text{end\_date}_{sp_1}] \cap [\text{start\_date}_{sp_2}, \text{end\_date}_{sp_2}] = \emptyset$

5. DecisionVariables

assign_worker_to_team $\in \{0, 1\}$: Binary assignment

select_user_story_for_sprint $\in \{0, 1\}$: Inclusion in sprint

estimate_task_effort $\in [1, 40]$: Integer effort in hours

set_sprint_duration $\in [5, 30]$: Days

allocate_budget_to_project $\in [0, 1000000]$: USD

schedule_sprint_start_date $\in [2024 - 01 - 01, 2026 - 12 - 31]$: Date

define_task_status $\in \{\text{todo, in\_progress, blocked, done}\}$

plan_release_version $\in \{\text{v1.0, v1.1, v2.0, v2.1, v3.0}\}$

set_worker_availability $\in [0, 40]$: Weekly hours

choose_documentation_format $\in \{\text{markdown, pdf, confluence}\}$

moderate_retrospective_assignment $\in \{\text{assigned, pending}\}$

update_product_backlog_order $\in [0, 1000]$: Rank

trigger_development_snapshot $\in \{0, 1\}$: Boolean trigger

set_epic_priority $\in \{\text{low, medium, high, critical}\}$