Optimization Model for SCRUM-Based Software Development

Domain Modeling System

September 5, 2025

Contents

1. Sets (Entities)

$\mathcal{P}$: Set of Projects

$\mathcal{T}$: Set of Teams

$\mathcal{W}$: Set of Workers

$\mathcal{F}$: Set of Features

$\mathcal{S}$: Set of Skills

$\mathcal{R}$: Set of Roles

$\mathcal{PO}$: Set of Product Owners

$\mathcal{SM}$: Set of Scrum Masters

$\mathcal{PB}$: Set of Product Backlogs

$\mathcal{SP}$: Set of Sprints

$\mathcal{US}$: Set of User Stories

$\mathcal{TSK}$: Set of Tasks

$\mathcal{DEV}$: Set of Development Snapshots

$\mathcal{BL}$: Set of Blockers

$\mathcal{SH}$: Set of Stakeholders

$\mathcal{VEL}$: Set of Velocity Records

$\mathcal{REP}$: Set of Release Plans

$\mathcal{RM}$: Set of Roadmaps

$\mathcal{SCB}$: Set of Scrum Boards

$\mathcal{FED}$: Set of Feature Documentations

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

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

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

$d \in \mathcal{DEV}$: Index for development snapshots

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

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

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

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

$rm \in \mathcal{RM}$: Index for roadmaps

$sc \in \mathcal{SCB}$: Index for scrum boards

$fd \in \mathcal{FED}$: Index for feature documentation

3. Goals

`maximize_project_budget`: $\max \sum_{p \in \mathcal{P}} \text{budget}_p$ (Weight: 1.5)

`minimize_project_duration`: $\min \sum_{p \in \mathcal{P}} (\text{project\_end}_p - \text{project\_start}_p)$ (Weight: 1.2)

`maximize_team_size`: $\max \sum_{t \in \mathcal{T}} \text{team\_size}_t$ (Weight: 1.0)

`minimize_worker_unavailability`: $\min \sum_{w \in \mathcal{W}} I(\text{availability}_w = \text{false})$ (Weight: 1.3)

`maximize_feature_priority`: $\max \sum_{f \in \mathcal{F}} \text{priority}_f$ (Weight: 1.4)

`minimize_task_effort`: $\min \sum_{k \in \mathcal{TSK}} \text{effort}_k$ (Weight: 1.1)

`maximize_user_story_points`: $\max \sum_{u \in \mathcal{US}} \text{story\_points}_u$ (Weight: 1.6)

`minimize_sprint_duration`: $\min \sum_{sp \in \mathcal{SP}} (\text{end\_date}_{sp} - \text{start\_date}_{sp})$ (Weight: 1.0)

`maximize_velocity_trend`: $\max \sum_{v \in \mathcal{VEL}} \text{trend}_v$ (Weight: 1.7)

`minimize_blocker_severity`: $\min \sum_{b \in \mathcal{BL}} \text{severity}_b$ (Weight: 1.3)

`maximize_documentation_coverage`: $\max \sum_{fd \in \mathcal{FED}} |\text{linked\_requirements}_{fd}|$ (Weight: 1.2)

`minimize_release_delay`: $\min \sum_{rp \in \mathcal{REP}} |\text{planned\_date}_{rp} - \text{actual\_release}|$ (Weight: 1.4)

`maximize_stakeholder_influence`: $\max \sum_{h \in \mathcal{SH}} \text{influence\_level}_h$ (Weight: 1.1)

`minimize_dev_snapshot_test_failures`: $\min \sum_{d \in \mathcal{DEV}} I(\text{test\_status}_d = \text{failed})$ (Weight: 1.2)

4. Conditions

`require_worker_email`: $\forall w \in \mathcal{W}, \text{email}_w \neq \emptyset$

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

`require_team_location`: $\forall t \in \mathcal{T}, \text{location}_t \in R^2$

`require_task_status`: $\forall k \in \mathcal{TSK}, \text{status}_k \in \{\text{todo}, \text{in progress}, \text{done}\}$

`require_sprint_goal`: $\forall sp \in \mathcal{SP}, \exists g \in \mathcal{SG} : \text{objective\_description}_g \neq \emptyset$

`require_product_backlog_entries`: $\forall pb \in \mathcal{PB}, \text{number\_of\_entries}_{pb} > 0$

`require_user_story_acceptance_criteria`: $\forall u \in \mathcal{US}, \text{acceptance\_criteria}_u \neq \emptyset$

`require_scboard_columns`: $\forall sc \in \mathcal{SCB}, \text{columns\_(todo/done...)}_{sc}$ defined

`require_feature_status`: $\forall f \in \mathcal{F}, \text{status}_f \in \{\text{planned}, \text{in progress}, \text{done}\}$

`require_release_status`: $\forall rp \in \mathcal{REP}, \text{status}_{rp} \in \{\text{planned}, \text{delayed}, \text{released}\}$

`require_worker_start_date`: $\forall w \in \mathcal{W}, \text{start\_date}_w \leq \text{current\_date}$

`require_sprint_achievement_goal`: $\forall sp \in \mathcal{SP}, \text{achievement\_of\_goal}_{sp} \in [0, 1]$

`require_skill_certification_status`: $\forall s \in \mathcal{S}, \text{certified}_s \in \{0, 1\}$

`require_roadmap_milestones`: $\forall rm \in \mathcal{RM}, \text{milestones}_{rm} \neq \emptyset$

`require_dev_snapshot_version`: $\forall d \in \mathcal{DEV}, \text{version\_number}_d$ is valid semantic version

5. DecisionVariables

$\text{assign\_worker\_to\_team}_{w,t} \in \{0, 1\}$

$\text{select\_feature\_for\_sprint}_{f,sp} \in \{0, 1\}$

$\text{plan\_sprint\_duration}_{sp} \in [1, 30]$

$\text{allocate\_effort\_per\_task}_{k} \in [0, 100]$

$\text{schedule\_release\_date}_{rp} \in [0, 100000]$

$\text{estimate\_story\_points}_{u} \in [0, 20]$

$\text{set\_task\_status\_code}_{k} \in \{0, 1, 2\}$

$\text{define\_team\_size}_{t} \in [1, 50]$

$\text{choose\_backlog\_priority}_{f} \in [1, 5]$

$\text{moderate\_retrospective\_count}_{sm} \in [0, 100]$

$\text{track\_velocity\_value}_{sp} \in [0, 50.0]$

$\text{activate\_blocker\_resolution}_{b} \in \{0, 1\}$

$\text{update\_documentation\_status}_{fd} \in \{0, 1, 2\}$

$\text{set\_influence\_weight}_{h} \in [0.0, 10.0]$

$\text{plan\_roadmap\_timeline}_{rm} \in [30, 3650]$