Optimization Model for SCRUM-Based Software Development

Domain Optimization System

September 5, 2025

Contents

1. Sets (Entities)

P: Set of Projects

T: Set of Teams

W: Set of Workers

F: Set of Features

S: Set of Skills

R: Set of Roles

PO: Set of Product Owners

SM: Set of Scrum Masters

PB: Set of Product Backlogs

SP: Set of Sprints

SPP: Set of Sprint Plannings

DS: Set of Daily Scrums

SR: Set of Sprint Reviews

SRE: Set of Sprint Retrospectives

SBL: Set of Sprint Backlogs

SG: Set of Sprint Goals

E: Set of Epics

US: Set of User Stories

TSK: Set of Tasks

DEV: Set of Development Snapshots

BL: Set of Blockers

SH: Set of Stakeholders

VEL: Set of Velocity Records

REP: Set of Release Plans

RM: Set of Roadmaps

SCB: Set of Scrum Boards

FED: Set of Feature Documentations

2. Indices

$p \in P$: Index for Project

$t \in T$: Index for Team

$w \in W$: Index for Worker

$f \in F$: Index for Feature

$s \in S$: Index for Skill

$r \in R$: Index for Role

$po \in PO$: Index for Product Owner

$sm \in SM$: Index for Scrum Master

$pb \in PB$: Index for Product Backlog

$sp \in SP$: Index for Sprint

$spp \in SPP$: Index for Sprint Planning

$ds \in DS$: Index for Daily Scrum

$sr \in SR$: Index for Sprint Review

$sre \in SRE$: Index for Sprint Retrospective

$sbl \in SBL$: Index for Sprint Backlog

$sg \in SG$: Index for Sprint Goal

$e \in E$: Index for Epic

$us \in US$: Index for User Story

$tsk \in TSK$: Index for Task

$dev \in DEV$: Index for Development Snapshot

$bl \in BL$: Index for Blocker

$sh \in SH$: Index for Stakeholder

$vel \in VEL$: Index for Velocity

$rep \in REP$: Index for Release Plan

$rm \in RM$: Index for Roadmap

$scb \in SCB$: Index for Scrum Board

$fed \in FED$: Index for Feature Documentation

3. Goals

`maximize_project_priority`: Maximize total project priority

$$\max \sum_{p \in P} \text{priority}_p \quad \text{(Weight: 1.0)}$$

`minimize_project_duration`: Minimize project end date

$$\min \sum_{p \in P} (\text{project\_end}_p - \text{project\_start}_p) \quad \text{(Weight: 0.8)}$$

`maximize_feature_completion`: Maximize completed features

$$\max \sum_{f \in F} I(\text{status}_f = \text{Done}) \quad \text{(Weight: 1.1)}$$

`maximize_user_story_points`: Maximize completed story points

$$\max \sum_{us \in US} \text{story\_points}_{us} \cdot x_{us}^{selected} \quad \text{(Weight: 1.3)}$$

`minimize_blocker_severity`: Minimize active blocker severity

$$\min \sum_{bl \in BL} \text{severity}_{bl} \cdot (1 - y_{bl}^{resolved}) \quad \text{(Weight: 1.5)}$$

`maximize_velocity_trend`: Maximize velocity trend

$$\max \sum_{vel \in VEL} \text{trend}_{vel} \quad \text{(Weight: 1.1)}$$

`minimize_release_delay`: Minimize delays in release plan

$$\min \sum_{rep \in REP} \max(0, \text{actual\_date} - \text{planned\_date}_{rep}) \quad \text{(Weight: 1.4)}$$

`minimize_daily_scrum_duration`: Reduce daily scrum time

$$\min \sum_{ds \in DS} \text{duration}_{ds} \quad \text{(Weight: 0.5)}$$

4. Conditions

`require_project_budget`: All projects must have budget

$$\text{budget}_p > 0 \quad \forall p \in P$$

`enforce_worker_email`: Email must be valid

$$\text{email}_w \neq \emptyset \quad \forall w \in W$$

`limit_team_size`: Maximum team size is 12

$$\text{team\_size}_t \leq 12 \quad \forall t \in T$$

`require_sprint_goal`: Each sprint must have a goal

$$\text{objective\_description}_{sg} \neq \emptyset \quad \forall sp \in SP$$

`validate_feature_priority`: Feature priority must be set

$$\text{priority}_f \in \{1, 2, 3, 4, 5\} \quad \forall f \in F$$

`require_product_owner`: Each project has a PO

$$\exists po \in PO : \text{manages\_backlog}(po, pb_p) \quad \forall p \in P$$

`limit_sprint_duration`: Sprint length 30 days

$$\text{end\_date}_{sp} - \text{start\_date}_{sp} \leq 30 \quad \forall sp \in SP$$

`require_blocker_resolution`: High-severity blockers resolved

$$\text{resolved\_on}_{bl} < \infty \quad \forall bl \in BL : \text{severity}_{bl} \geq 4$$

5. DecisionVariables

$x_{w,t} \in \{0, 1\}$: Worker w assigned to team t

$y_{us} \in \{0, 1\}$: User story us selected for sprint

$d_{sp} \in [1, 30]$: Duration of sprint sp in days

$e_{tsk} \in R^+$: Effort estimate for task tsk

$p_f \in \{1, \ldots, 5\}$: Priority of feature f

$b_p \in [1000, 1000000]$: Budget allocated to project p

$r_{rep} \in \{1, \ldots, 365\}$: Release day of year for rep

$s_t \in \{3, \ldots, 12\}$: Size of team t

$v_\Delta \in [-1.0, 1.0]$: Velocity trend adjustment

$m_{sre} \in [15, 90]$: Retrospective moderation time

$v_{doc} \in [1.0, 10.0]$: Documentation version

$z_{bl} \in \{0, 1\}$: Blocker bl resolved

$a_{sh} \in \{0, 1\}$: Stakeholder sh attends review

$env_{dev} \in \{0, 1, 2\}$: Deployment target (0=dev,1=staging,2=prod)