SCRUM-Based Software Development Optimization Model

Optimization Team

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 Projects

$t \in T$: Index for Teams

$w \in W$: Index for Workers

$f \in F$: Index for Features

$s \in S$: Index for Skills

$r \in R$: Index for Roles

$po \in PO$: Index for Product Owners

$sm \in SM$: Index for Scrum Masters

$pb \in PB$: Index for Product Backlogs

$sp \in SP$: Index for Sprints

$us \in US$: Index for User Stories

$tsk \in TSK$: Index for Tasks

$bl \in BL$: Index for Blockers

$sh \in SH$: Index for Stakeholders

$vel \in VEL$: Index for Velocity records

$rep \in REP$: Index for Release Plans

$rm \in RM$: Index for Roadmaps

$fed \in FED$: Index for Feature Documentations

3. Goals

`maximize_project_priority`: $\max \sum_{p \in P} \text{priority}_p \cdot w_{G0}$

`minimize_project_cost`: $\min \sum_{p \in P} \text{budget}_p \cdot w_{G1}$

`maximize_team_size`: $\max \sum_{t \in T} \text{team\_size}_t \cdot w_{G2}$

`minimize_sprint_duration`: $\min \sum_{sp \in SP} (\text{end\_date}_{sp} - \text{start\_date}_{sp}) \cdot w_{G3}$

`maximize_velocity`: $\max \sum_{vel \in VEL} \text{avg.\_story\_points}_{vel} \cdot w_{G4}$

`minimize_task_effort`: $\min \sum_{tsk \in TSK} \text{effort}_{tsk} \cdot w_{G5}$

`maximize_feature_completion`: $\max \sum_{f \in F} I(\text{status}_f = \text{Done}) \cdot w_{G6}$

`minimize_blocker_severity`: $\min \sum_{bl \in BL} \text{severity}_{bl} \cdot w_{G7}$

`maximize_user_story_points`: $\max \sum_{us \in US} \text{story\_points}_{us} \cdot x_{us} \cdot w_{G8}$ where x_{us} indicates completion

`minimize_worker_unavailability`: $\min \sum_{w \in W} I(\text{availability}_w = \text{False}) \cdot w_{G9}$

`maximize_skill_certification`: $\max \sum_{s \in S} \text{certified}_s \cdot w_{G10}$

`minimize_release_delay`: $\min \sum_{rep \in REP} |\text{actual\_date}_{rep} - \text{planned\_date}_{rep}| \cdot w_{G11}$

`maximize_stakeholder_influence`: $\max \sum_{sh \in SH} \text{influence\_level}_{sh} \cdot y_{sh} \cdot w_{G12}$ where $y_{sh} = 1$ if participating

`minimize_documentation_age`: $\min \sum_{fed \in FED} (\text{current\_date} - \text{creation\_date}_{fed}) \cdot w_{G13}$

4. Conditions

`require_project_status_active`: $\forall p \in P, \text{status}_p = \text{Active}$

`ensure_team_has_scrum_master`: $\forall t \in T, \exists sm \in SM \mid R6(t, sm)$

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

`enforce_task_status_not_blocked`: $\forall tsk \in TSK, \text{status}_{tsk} \neq \text{Blocked}$

`limit_worker_per_team`: $\forall w \in W, \sum_{t \in T} x_{w,t} \leq 1$ where $x_{w,t}$ is assignment

`require_sprint_goal_defined`: $\forall sp \in SP, \exists sg \in SG \mid R13(sp, sg) \wedge \text{objective\_description}_{sg} \neq \emptyset$

`enforce_epic_priority`: $\forall e \in E, \text{priority}_e \in \{1, 2, 3, 4, 5\}$

`require_feature_status`: $\forall f \in F, \text{status}_f \in \{\text{To Do, In Progress, Done}\}$

`ensure_velocity_based_on_recent_sprints`: $\forall vel \in VEL, \text{number\_of\_sprints\_used}_{vel} \geq 3$

`require_product_owner_email`: $\forall po \in PO, \text{email}_{po}$ is valid

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

`require_stakeholder_relevance`: $\forall sh \in SH, \text{relevance\_to\_feature}_{sh} \geq 1$

`ensure_documentation_linked`: $\forall f \in F, \exists fed \in FED \mid R15(fed, f)$

`require_task_type_defined`: $\forall tsk \in TSK, \text{type}_{tsk} \neq \emptyset$

5. DecisionVariables

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

$y_{us,sp} \in \{0, 1\}$: 1 if user story us is in sprint sp

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

$e_{tsk} \in [0, 40]$: Effort estimate for task tsk

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

$a_{sg} \in [0, 1]$: Achievement level of sprint goal sg

$z_f \in \{0, 1\}$: 1 if feature f is activated in release

$r_{bl} \in \{0, 1\}$: 1 if blocker bl is resolved

$rd_{rep} \in [0, 365]$: Days from now when release rep is scheduled

$u_{fed} \in \{0, 1\}$: 1 if documentation fed is updated

$m_{sre} \in \{0, 1\}$: 1 if Scrum Master moderates retrospective sre

$p_{sh,sr} \in \{0, 1\}$: 1 if stakeholder sh participates in sprint review sr

$h_{w,s} \in [0, 160]$: Hours invested in skill s for worker w

$dep_{dev} \in \{0, 1\}$: 1 if development snapshot dev is deployed

$ce_e \in \{0, 1\}$: 1 if epic e is created