

Optimization Model for SCRUM-Based Software Development

Domain Modeling System

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1. Sets (Entities)

P : Set of Projects $\{p \in \text{Project}\}$

T : Set of Teams $\{t \in \text{Team}\}$

W : Set of Workers $\{w \in \text{Worker}\}$

F : Set of Features $\{f \in \text{Feature}\}$

S : Set of Skills $\{s \in \text{Skill}\}$

R : Set of Roles $\{r \in \text{Role}\}$

PO : Set of Product Owners $\{po \in \text{ProductOwner}\}$

SM : Set of Scrum Masters $\{sm \in \text{ScrumMaster}\}$

PB : Set of Product Backlogs $\{pb \in \text{ProductBacklog}\}$

SP : Set of Sprints $\{sp \in \text{Sprint}\}$

US : Set of User Stories $\{us \in \text{UserStory}\}$

TSK : Set of Tasks $\{tsk \in \text{Task}\}$

E : Set of Epics $\{e \in \text{Epic}\}$

BL : Set of Blockers $\{bl \in \text{Blocker}\}$

SH : Set of Stakeholders $\{sh \in \text{Stakeholder}\}$

VEL : Set of Velocity records $\{vel \in \text{Velocity}\}$

REP : Set of Release Plans $\{rep \in \text{ReleasePlan}\}$

RM : Set of Roadmaps $\{rm \in \text{Roadmap}\}$

SCB : Set of Scrum Boards $\{scb \in \text{ScrumBoard}\}$

FED : Set of Feature Documentations $\{fed \in \text{FeatureDocumentation}\}$

DEV : Set of Development Snapshots $\{dev \in \text{DevelopmentSnapshot}\}$

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

$sp \in SP$: 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

$rep \in REP$: Index for release plans

3. Goals

maximize_project_priority: $\max \sum_{p \in P} \text{priority}_p \cdot I(\text{status}_p = \text{active})$, Weight: 1.5
 minimize_project_duration: $\min \sum_{p \in P} (\text{project_end}_p - \text{project_start}_p)$, Weight: 1.2
 maximize_team_size: $\max \sum_{t \in T} \text{team_size}_t$, Weight: 1.0
 minimize_worker_unavailability: $\min \sum_{w \in W} I(\text{status}_w = \text{unavailable})$, Weight: 0.8
 maximize_skill_certification: $\max \sum_{s \in S} I(\text{certified}_s = \text{true})$, Weight: 1.3
 maximize_feature_priority: $\max \sum_{f \in F} \text{priority}_f$, Weight: 1.4
 minimize_sprint_duration: $\min \frac{1}{|SP|} \sum_{sp \in SP} (\text{end_date}_{sp} - \text{start_date}_{sp})$, Weight: 1.1
 maximize_sprint_achievement: $\max \frac{1}{|SP|} \sum_{sp \in SP} \text{achievement_of_goal}_{sp}$, Weight: 1.6
 maximize_story_points_completed: $\max \sum_{us \in US} \text{story_points}_{us} \cdot I(\text{status}_{us} = \text{done})$, Weight: 1.7
 minimize_blocker_severity: $\min \sum_{bl \in BL} \text{severity}_{bl} \cdot I(\text{status}_{bl} = \text{open})$, Weight: 1.5
 maximize_stakeholder_influence: $\max \sum_{sh \in SH} \text{influence_level}_{sh}$, Weight: 1.2
 maximize_velocity_trend: $\max \sum_{vel \in VEL} \text{trend}_{vel}$, Weight: 1.3
 minimize_release_delay: $\min \sum_{rep \in REP} |\text{actual_release} - \text{planned_date}_{rep}|$, Weight: 1.4
 maximize_documentation_coverage: $\max \sum_{fed \in FED} |\text{linked_requirements}_{fed}|$, Weight: 1.1
 maximize_daily_scrum_attendance: $\max \sum_{sp \in SP} \sum_{d \in \text{days}(sp)} \text{schedule_daily_scrum}_d$, Weight: 0.9

4. Conditions

require_project_status_active: $\forall p \in P : \text{status}_p = \text{active}$
 require_team_status_active: $\forall t \in T : \text{team_status}_t = \text{active}$
 require_worker_status_active: $\forall w \in W : \text{status}_w = \text{active}$
 require_feature_status_not_done: $\forall f \in F : \text{status}_f \neq \text{done}$
 require_sprint_status_active: $\forall sp \in SP : \text{status}_{sp} \in \{\text{planned}, \text{active}\}$
 require_task_status_not_done: $\forall tsk \in TSK : \text{status}_{tsk} \neq \text{done}$
 require_user_story_priority_above_threshold: $\forall us \in US : \text{priority}_{us} > 3$
 require_skill_level_above_intermediate: $\forall s \in S : \text{level}_s \geq \text{intermediate}$
 require_blocker_status_open: $\forall bl \in BL : \text{status}_{bl} = \text{open}$
 require_stakeholder_relevance_high: $\forall sh \in SH : \text{relevance_to_feature}_{sh} = \text{high}$
 require_velocity_min_value: $\forall vel \in VEL : \text{avg_story_points}_{vel} \geq 10$
 require_sprint_goal_defined: $\forall sp \in SP : \exists sg \in SG : \text{objective_description}_{sg} \neq \emptyset$
 require_release_status_planned: $\forall rep \in REP : \text{status}_{rep} = \text{planned}$
 require_board_updated_recently: $\forall scb \in SCB : \text{last_updated}_{scb} \geq \text{now} - 24\text{h}$
 require_documentation_author_assigned: $\forall fed \in FED : \text{author}_{fed} \neq \emptyset$

5. Decision Variables

assign_worker_to_task: $x_{w,tsk} \in \{0,1\}$
select_feature_for_sprint: $y_f \in \{0,1\}$
plan_sprint_duration: $d_{sp} \in \{7,14,21\}$
allocate_budget_to_project: $b_p \in [1000,100000]$
schedule_daily_scrum: $s_d \in \{0,1\}$
activate_team: $a_t \in \{0,1\}$
start_project: $s_p \in \{0,1\}$
resolve_blocker: $r_{bl} \in \{0,1\}$
approve_release: $a_{rep} \in \{0,1\}$
update_documentation: $u_{fed} \in \{0,1\}$
moderate_retrospective: $m_{sre} \in \{0,1\}$
estimate_story_points: $sp_{us} \in [1,13], \text{integer}$
define_sprint_goal: $g_{sp} \in \{0,1\}$
track_velocity: $v_{vel} \in \{0,1\}$
invite_stakeholder: $i_{sh} \in \{0,1\}$