Scrum Project Optimization Model

Le Chat

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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
- $\mathcal{SPP}$: Set of Sprint Plannings
- $\mathcal{DS}$: Set of Daily Scrums
- $\mathcal{SR}$: Set of Sprint Reviews

- $\mathcal{SRE}$: Set of Sprint Retrospectives
- $\mathcal{SBL}$: Set of Sprint Backlogs
- $\mathcal{SG}$: Set of Sprint Goals
- $\mathcal{E}$: Set of Epics
- $\mathcal{US}$: 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 Velocities
- $\mathcal{REP}$: Set of Release Plans
- $\mathcal{RM}$: Set of Roadmaps
- $\mathcal{SCB}$: Set of Scrum Boards
- $\mathcal{FED}$: Set of Feature Documentations

2   Indices

- $p \in \mathcal{P}$
- $t \in \mathcal{T}$
- $w \in \mathcal{W}$
- $f \in \mathcal{F}$
- $s \in \mathcal{S}$
- $r \in \mathcal{R}$
- $po \in \mathcal{PO}$
- $sm \in \mathcal{SM}$
- $pb \in \mathcal{PB}$
- $sp \in \mathcal{SP}$
- $spp \in \mathcal{SPP}$
- $ds \in \mathcal{DS}$

- $sr \in \mathcal{SR}$

- $sre \in \mathcal{SRE}$

- $sbl \in \mathcal{SBL}$

- $sg \in \mathcal{SG}$

- $e \in \mathcal{E}$

- $us \in \mathcal{US}$

- $tsk \in \mathcal{TSK}$

- $dev \in \mathcal{DEV}$

- $bl \in \mathcal{BL}$

- $sh \in \mathcal{SH}$

- $vel \in \mathcal{VEL}$

- $rep \in \mathcal{REP}$

- $rm \in \mathcal{RM}$

- $scb \in \mathcal{SCB}$

- $fed \in \mathcal{FED}$

3   Goals

- **G0 (maximize_team_productivity):**

$$\text{Maximize} \sum_{t \in \mathcal{T}} \text{team\_size}_t \times \text{velocity}_{vel}$$

- **G1 (maximize_sprint_velocity):**

$$\text{Maximize} \sum_{vel \in \mathcal{VEL}} \text{avg.\_story\_points}_{vel}$$

- **G2 (minimize_blockers):**

$$\text{Minimize} \sum_{bl \in \mathcal{BL}} \mathbb{I}(\text{status}_{bl} = \text{unresolved})$$

- **G3 (maximize_feature_completion):**

$$\text{Maximize} \sum_{f \in \mathcal{F}} \mathbb{I}(\text{status}_f = \text{completed})$$

- **G4 (maximize_team_satisfaction):**

$$\text{Maximize} \sum_{sre \in \mathcal{SRE}} \text{team\_satisfaction}_{sre}$$

- **G5 (minimize_project_budget_overrun):**

$$\text{Minimize} \sum_{p \in \mathcal{P}} \max(0, \text{actual\_budget}_p - \text{planned\_budget}_p)$$

- **G6 (maximize_stakeholder_satisfaction):**

$$\text{Maximize} \sum_{sh \in \mathcal{SH}} \text{relevance\_to\_feature}_{sh}$$

- **G7 (maximize_sprint_goal_achievement):**

$$\text{Maximize} \sum_{sg \in \mathcal{SG}} \text{achievement\_status}_{sg}$$

- **G8 (minimize_task_effort):**

$$\text{Minimize} \sum_{tsk \in \mathcal{TSK}} \text{effort}_{tsk}$$

- **G9 (maximize_skill_coverage):**

$$\text{Maximize} \sum_{w \in \mathcal{W}, s \in \mathcal{S}} \text{has\_skill}_{w,s}$$

- **G10 (minimize_sprint_duration):**

$$\text{Minimize} \sum_{sp \in \mathcal{SP}} \text{duration}_{sp}$$

- **G11 (maximize_epic_completion):**

$$\text{Maximize} \sum_{e \in \mathcal{E}} \mathbb{I}(\text{status}_e = \text{completed})$$

- **G12 (maximize_user_story_completion):**

$$\text{Maximize} \sum_{us \in \mathcal{US}} \mathbb{I}(\text{status}_{us} = \text{completed})$$

- **G13 (maximize_development_snapshot_quality):**

$$\text{Maximize} \sum_{dev \in \mathcal{DEV}} \mathbb{I}(\text{test\_status}_{dev} = \text{passed})$$

- **G14 (minimize_role_overlap):**

$$\text{Minimize} \sum_{w \in \mathcal{W}, r \in \mathcal{R}} \mathbb{I}(\text{takes\_on\_role}_{w,r} > 1)$$

4   Conditions

- **C0 (team_size_limit):**

$$\text{team\_size}_t \leq 9 \quad \forall t \in \mathcal{T}$$

- **C1 (sprint_duration_fixed):**

$$\text{duration}_{sp} = 14 \quad \forall sp \in \mathcal{SP}$$

- **C2 (blocker_severity_high):**

$$\text{resolved\_on}_{bl} - \text{detected\_on}_{bl} \leq 2 \quad \forall bl \in \mathcal{BL} \text{ with severity} = \text{high}$$

- **C3 (feature_priority_high):**

$$\text{priority}_f = \text{high} \quad \forall f \in \mathcal{F} \text{ in current sprint}$$

- **C4 (worker_availability):**

$$\text{availability}_w = \text{available} \quad \forall w \in \mathcal{W} \text{ assigned to task}$$

- **C5 (skill_requirement):**

$$\sum_{w \in \mathcal{W}} \text{has\_skill}_{w,s} \geq 1 \quad \forall tsk \in \mathcal{TSK} \text{ requiring skill } s$$

- **C6 (product_backlog_status):**

$$\text{status}_{pb} = \text{approved} \quad \forall pb \in \mathcal{PB}$$

- **C7 (sprint_goal_achievable):**

$$\sum_{us \in \mathcal{US}} \text{story\_points}_{us} \leq \text{velocity}_{vel} \quad \forall sg \in \mathcal{SG}$$

- **C8 (release_plan_status):**

$$\text{status}_{rep} = \text{confirmed} \quad \forall rep \in \mathcal{REP}$$

- **C9 (scrum_board_columns):**

$$|\text{columns}_{scb}| \geq 3 \quad \forall scb \in \mathcal{SCB}$$

- **C10 (velocity_trend_positive):**

$$\text{trend}_{vel} > 0 \quad \forall vel \in \mathcal{VEL}$$

- **C11 (roadmap_milestones):**

$$\sum_{rep \in \mathcal{REP}} \text{includes\_milestone}_{rep,m} \geq 1 \quad \forall m \in \text{milestones}_{rm}$$

- **C12 (stakeholder_influence):**

$$\sum_{sr \in \mathcal{SR}} \text{attendees}_{sr,sh} \geq 1 \quad \forall sh \in \mathcal{SH} \text{ with influence\_level} = \text{high}$$

- **C13 (documentation_completeness):**

$$\sum_{fed \in \mathcal{FED}} \text{linked\_requirements}_{fed,f} \geq 1 \quad \forall f \in \mathcal{F}$$

- **C14 (budget_constraint):**

$$\sum_{p \in \mathcal{P}} \text{actual\_budget}_p \leq \text{planned\_budget}_p$$

5 Decision Variables

- $x_{w,tsk} \in \{0,1\}$: **DV0 (assign_worker_to_task)**

- $y_{us,sbl} \in \{0,1\}$: **DV1 (select_user_story_for_sprint)**

- $d_{sp} \in \mathbb{Z}^+$: **DV2 (set_sprint_duration)**

- $b_f \in \mathbb{R}^+$: **DV3 (allocate_budget_to_feature)**

- $z_{w,r} \in \{0,1\}$: **DV4 (assign_role_to_worker)**

- $r_{bl} \in \{0,1\}$: **DV5 (resolve_blocker)**

- $p_f \in \{1,2,3,4,5\}$: **DV6 (set_feature_priority)**

- $s_t \in \mathbb{Z}^+$: **DV7 (set_team_size)**

- $a_{sg} \in \mathbb{R}^+$: **DV8 (set_sprint_goal_achievement)**

- $k_{w,s} \in \{0,1\}$: **DV9 (assign_skill_to_worker)**

- $l_{f,rep} \in \{0,1\}$: **DV10 (select_feature_for_release)**

- $e_{tsk} \in \mathbb{Z}^+$: **DV11 (set_task_effort)**

- $v_{sh,f} \in \{1,2,3,4,5\}$: **DV12 (set_stakeholder_relevance)**

- $g_{vel} \in \mathbb{R}^+$: **DV13 (set_velocity_avg)**

- $q_{dev} \in \{0,1\}$: **DV14 (set_development_snapshot_status)**