SCRUM Planning & Delivery Optimization Model

TruelyMostWanted

September 5, 2025

Contents

1 1. Sets (Entities) **2**

2 2. Indices **3**

3 3. Goals **4**

4 4. Conditions **4**

5 5. DecisionVariables **5**

1 1. Sets (Entities)

- P : set of **Projects** (Entity: Project).
- T : set of **Teams** (Entity: Team).
- W : set of **Workers** (Entity: Worker).
- F : set of **Features** (Entity: Feature).
- S : set of **Skills** (Entity: Skill).
- R : set of **Roles** (Entity: Role).
- PO : set of **Product Owners** (Entity: ProductOwner).
- SM : set of **Scrum Masters** (Entity: ScrumMaster).
- PB : set of **Product Backlogs** (Entity: ProductBacklog).
- SP : set of **Sprints** (Entity: Sprint).
- SPP : set of **Sprint Plannings** (Entity: SprintPlanning).
- DS : set of **Daily Scrums** (Entity: DailyScrum).
- SR : set of **Sprint Reviews** (Entity: SprintReview).
- SRE : set of **Sprint Retrospectives** (Entity: SprintRetrospective).
- SBL : set of **Sprint Backlogs** (Entity: SprintBacklog).
- SG : set of **Sprint Goals** (Entity: SprintGoal).
- E : set of **Epics** (Entity: Epic).
- US : set of **User Stories** (Entity: UserStory).
- TSK : set of **Tasks** (Entity: Task).
- DEV : set of **Development Snapshots** (Entity: DevelopmentSnapshot).
- BL : set of **Blockers** (Entity: Blocker).
- SH : set of **Stakeholders** (Entity: Stakeholder).
- VEL : set of **Velocity entries** (Entity: Velocity).
- REP : set of **Release Plans** (Entity: ReleasePlan).
- RM : set of **Roadmaps** (Entity: Roadmap).
- SCB : set of **Scrum Boards** (Entity: ScrumBoard).
- FED : set of **Feature Documentations** (Entity: FeatureDocumentation).
- $\mathcal{W}\_\mathcal{T} \subseteq W \times T$: worker-to-team pairs (R2).
- $\mathcal{W}\_\mathcal{S} \subseteq W \times S$: worker-to-skill pairs (R3).
- $\mathcal{W}\_\mathcal{R} \subseteq W \times R$: worker-to-role pairs (R4).

- $\mathcal{PO\_PB} \subseteq PO \times PB$ (R5), $\mathcal{T\_SM} \subseteq T \times SM$ (R6).
- $\mathcal{PB\_F} \subseteq PB \times F$ (R7), $\mathcal{PB\_E} \subseteq PB \times E$ (R8).
- $\mathcal{E\_US} \subseteq E \times US$ (R9), $\mathcal{US\_TSK} \subseteq US \times TSK$ (R10).
- $\mathcal{US\_SBL} \subseteq US \times SBL$ (R11), $\mathcal{SBL\_SP} \subseteq SBL \times SP$ (R12).
- $\mathcal{SP\_SG} \subseteq SP \times SG$ (R13), $\mathcal{SCB\_TSK} \subseteq SCB \times TSK$ (R14).
- $\mathcal{FED\_F} \subseteq FED \times F$ (R15), $\mathcal{TSK\_BL} \subseteq TSK \times BL$ (R16).
- $\mathcal{SH\_SR} \subseteq SH \times SR$ (R17), $\mathcal{SM\_SRE} \subseteq SM \times SRE$ (R18).
- $\mathcal{VEL\_T} \subseteq VEL \times T$ (R19), $\mathcal{REP\_F} \subseteq REP \times F$ (R20).
- $\mathcal{REP\_RM} \subseteq REP \times RM$ (R21), $\mathcal{SP\_DEV} \subseteq SP \times DEV$ (R22).

2 2. Indices

- $p \in P,\ t \in T,\ w \in W,\ f \in F,\ s \in S,\ r \in R,\ po \in PO,\ sm \in SM,\ pb \in PB.$
- $sp \in SP,\ spp \in SPP,\ ds \in DS,\ sr \in SR,\ sre \in SRE,\ sbl \in SBL,\ sg \in SG.$
- $e \in E,\ us \in US,\ tsk \in TSK,\ dev \in DEV,\ bl \in BL,\ sh \in SH,\ vel \in VEL.$
- $rep \in REP,\ rm \in RM,\ scb \in SCB,\ fed \in FED.$

Parameters (from Attributes)

- budget_p (Project.budget), priority_f^F (Feature.priority), $\text{effort}_{tsk}^{TSK}$ (Task.effort).
- spoints_{us} (UserStory.story_points), benefit_{sg} (SprintGoal.benefit).
- avail_w (Worker.availability), sev_{bl} (Blocker.severity).
- tsat_{sre} (SprintRetrospective.team_satisfaction), dur_{spp}^{SPP} (SprintPlanning.duration_(min)).
- dur_{ds}^{DS} (DailyScrum.duration), dur_{sr}^{SR} (SprintReview.duration).
- teff_{sbl} (SprintBacklog.total_effort), ntasks_{sbl} (SprintBacklog.number_of_tasks).
- attcnt_{sr} (SprintReview.attendees_count), achg_{sp} (Sprint.achievement_of_goal).
- $\overline{V}_{sp}$ (Velocity.max_velocity mapped to sprint), $\underline{V}_{sp}$ (Velocity.min_velocity).
- $\text{inPB}_f \in \{0,1\}$ (feature f contained in some ProductBacklog via R7), $\text{H} > 0$ planning hours per sprint.

Decision Variables (from DecisionVariables.csv)

- $x_{us,sp} \in \{0,1\}$ (DV0) assign user story to sprint.
- $z_{tsk,sp} \in \{0,1\}$ (DV1) schedule task in sprint.
- $y_{tsk,w} \in \{0,1\}$ (DV2) assign task to worker.
- $b_f \geq 0$ (DV3) budget allocated to feature.
- $g_{sp} \in \{0,1\}$ (DV4) sprint goal achieved indicator.

- $r_f \in \{0,1\}$ (DV5) include feature in release plan.
- $u_{sp} \geq 0$ (DV6) used capacity in sprint (story points).
- $k_{sp} \in \mathbb{Z}_+$ (DV7) selected capacity (story points) for sprint.
- $e_e \in \{0,1\}$ (DV8) include epic.
- $m_{sr,sh} \in \{0,1\}$ (DV9) stakeholder participates in review.
- $o_{tsk} \in \{0,1\}$ (DV10) task currently blocked.
- $rbl_{bl} \in \{0,1\}$ (DV11) blocker resolved.
- $c_{sp} \in \mathbb{Z}_+$ (DV12) Scrum Board card count in sprint.
- $s_{us,sbl} \in \{0,1\}$ (DV13) story in sprint backlog.

3 3. Goals

We scalarize multiple goals into a single objective:

$$\max Z \;=\; 1.0 \sum_{(sp,sg)\in \mathcal{SP}\_\mathcal{SG}} \text{benefit}_{sg}\, g_{sp} - 0.9 \sum_{f\in F} b_f + 1.0 \sum_{us\in US} \sum_{sp\in SP} \text{spoints}_{us}\, x_{us,sp} - 0.7 \sum_{tsk\in TSK} \sum_{sp\in SP} \text{effort}^{TSK}_{tsk}\, z_{tsk,s}$$

- **G0 maximize_sprint_goal_benefit**: $\max \sum_{(sp,sg)\in \mathcal{SP}\_\mathcal{SG}} \text{benefit}_{sg}\, g_{sp}$.
- **G1 minimize_project_budget_usage**: $\min \sum_{f\in F} b_f$.
- **G2 maximize_delivered_story_points**: $\max \sum_{us,sp} \text{spoints}_{us}\, x_{us,sp}$.
- **G3 minimize_total_task_effort**: $\min \sum_{tsk,sp} \text{effort}^{TSK}_{tsk}\, z_{tsk,sp}$.
- **G4 maximize_feature_priority_released**: $\max \sum_f \text{priority}^F_f\, r_f$.
- **G5 minimize_blocker_impact**: $\min \sum_{bl} \text{sev}_{bl}\,(1 - rbl_{bl})$.
- **G6 maximize_team_satisfaction**: $\max \sum_{sre} \text{tsat}_{sre}$.
- **G7 minimize_sprint_planning_time**: $\min \sum_{spp} \text{dur}^{SPP}_{spp}$.
- **G8 minimize_daily_scrum_time**: $\min \sum_{ds} \text{dur}^{DS}_{ds}$.
- **G9 minimize_sprint_review_time**: $\min \sum_{sr} \text{dur}^{SR}_{sr}$.
- **G10 minimize_sprint_backlog_total_effort**: $\min \sum_{sbl} \text{teff}_{sbl}$.
- **G11 maximize_worker_availability_used**: $\max \sum_{w,tsk} \text{avail}_w\, y_{tsk,w}$.

4 4. Conditions

- **C0 unique_story_assignment**: $\sum_{sp\in SP} x_{us,sp} \leq 1 \quad \forall us \in US.$
- **C1 sprint_capacity_story_points**: $\sum_{us\in US} \text{spoints}_{us}\, x_{us,sp} \leq \overline{V}_{sp} \quad \forall sp \in SP.$
- **C2 worker_capacity_effort**: $\sum_{tsk\in TSK} \text{effort}^{TSK}_{tsk}\, y_{tsk,w} \leq \text{H} \cdot \text{avail}_w \quad \forall w \in W.$

- **C3 project_budget_cap**: $\sum_{f \in F(p)} b_f \leq \text{budget}_p \quad \forall p \in P.$
- **C4 goal_activation_consistency**: $g_{sp} \leq \text{achg}_{sp} \quad \forall sp \in SP.$
- **C5 feature_must_be_in_backlog**: $r_f \leq \text{inPB}_f \quad \forall f \in F.$
- **C6 minimum_review_attendance**: $\sum_{sh \in SH} m_{sr,sh} \geq 1 \quad \forall sr \in SR.$
- **C7 tasks_within_sprint_backlog**: $\sum_{tsk \in TSK} z_{tsk,sp} \leq \sum_{\substack{sbl \in SBL: \\ (sbl,sp) \in \mathcal{SBL\_SP}}} \text{ntasks}_{sbl} \quad \forall sp \in SP.$
- **C8 blocked_task_requires_resolution**: $z_{tsk,sp} \leq rbl_{bl} \quad \forall (tsk, bl) \in \mathcal{TSK\_BL}, \ \forall sp \in SP.$
- **C9 scrumboard_matches_scheduled_tasks**: $c_{sp} = \sum_{tsk \in TSK} z_{tsk,sp} \quad \forall sp \in SP.$
- **C10 epic_included_if_story_planned**: $\sum_{sp \in SP} x_{us,sp} \leq \sum_{\substack{e \in E: \\ (e,us) \in \mathcal{E\_US}}} e_e \quad \forall us \in US.$
- **C11 velocity_lower_bound**: $k_{sp} \geq \underline{V}_{sp} \quad \forall sp \in SP.$

5 5. DecisionVariables

- DV0 $x_{us,sp} \in \{0,1\}$, DV1 $z_{tsk,sp} \in \{0,1\}$, DV2 $y_{tsk,w} \in \{0,1\}$, DV3 $b_f \in \mathbb{R}_+$.
- DV4 $g_{sp} \in \{0,1\}$, DV5 $r_f \in \{0,1\}$, DV6 $u_{sp} \in \mathbb{R}_+$, DV7 $k_{sp} \in \mathbb{Z}_+$.
- DV8 $e_e \in \{0,1\}$, DV9 $m_{sr,sh} \in \{0,1\}$, DV10 $o_{tsk} \in \{0,1\}$, DV11 $rbl_{bl} \in \{0,1\}$.
- DV12 $c_{sp} \in \mathbb{Z}_+$, DV13 $s_{us,sbl} \in \{0,1\}$.