SCRUM Planning Optimization Model

Generated for TruelyMostWanted

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Contents

1 Sets (Entities)

- P — Projects (`Project`)
- T — Teams (`Team`)
- W — Workers (`Worker`)
- F — Features (`Feature`)
- S — Skills (`Skill`)
- R — Roles (`Role`)
- PO — Product Owners (`ProductOwner`)
- SM — Scrum Masters (`ScrumMaster`)
- PB — Product Backlogs (`ProductBacklog`)
- SP — Sprints (`Sprint`)
- SPP — Sprint Plannings (`SprintPlanning`)
- DS — Daily Scrums (`DailyScrum`)
- SR — Sprint Reviews (`SprintReview`)
- SRE — Sprint Retrospectives (`SprintRetrospective`)
- SBL — Sprint Backlogs (`SprintBacklog`), assume a unique backlog per sprint $s \in SP$
- SG — Sprint Goals (`SprintGoal`)
- E — Epics (`Epic`)
- US — User Stories (`UserStory`)
- TSK — Tasks (`Task`)
- DEV — Development Snapshots (`DevelopmentSnapshot`)
- BL — Blockers (`Blocker`)
- SH — Stakeholders (`Stakeholder`)
- VEL — Velocity records (`Velocity`)
- REP — Release Plans (`ReleasePlan`)
- RM — Roadmaps (`Roadmap`)
- SCB — Scrum Boards (`ScrumBoard`)
- FED — Feature Documentations (`FeatureDocumentation`)

2 Indices

- $p \in P$, $t \in T$, $w \in W$, $f \in F$, $e \in E$, $us \in US$, $tsk \in TSK$, $bl \in BL$, $s \in SP$, $sbl \in SBL$, $sg \in SG$, $vel \in VEL$, $rep \in REP$, $pb \in PB$, $sr \in SR$, $ds \in DS$, $scb \in SCB$, $fed \in FED$
- Relation indicator parameters (from `Relationships.csv`):
  - R_containsUS$(e, us) \in \{0, 1\}$ for `contains_user_story` (R10)
  - R_USinSBL$(us, s) \in \{0, 1\}$ allowed by `is_in_sprint_backlog` + `belongs_to_sprint` (R11, R12)
  - R_taskBlocked$(tsk, bl) \in \{0, 1\}$ for `is_blocked_by` (R16)
  - R_featureInREP$(rep, f) \in \{0, 1\}$ for `plans_release` (R20)
  - R_PBcontainsF(pb, f), R_PBcontainsE(pb, e) (R7, R8)
  - R_Sgoal$(s, sg) \in \{0, 1\}$ for `pursues_goal` (R13)

3 Goals

- **G0 maximize_velocity_avg_story_points**:

$$\max \sum_{vel \in VEL} \alpha_{G0} \cdot \text{avgsp}_{vel}$$

  where $\alpha_{G0} = 1.00$ and avgsp_{vel} corresponds to `Velocity.avg._story_points`.

- **G1 minimize_product_backlog_entries**:

$$\min \sum_{pb \in PB} \alpha_{G1} \cdot \text{entries}_{pb}$$

  with $\alpha_{G1} = 0.40$ and $\text{entries}_{pb} =$ `ProductBacklog.number_of_entries`.

- **G2 minimize_project_budget_use**:

$$\min \sum_{p \in P} \alpha_{G2} \cdot \text{budgetSpent}_{p}$$

  $\alpha_{G2} = 0.85$, decision variable $\text{budgetSpent}_{p} =$ `DV6` (p), bounded by `Project.budget`.

- **G3 maximize_sprint_goal_achievement**:

$$\max \sum_{s \in SP} \sum_{sg \in SG} \alpha_{G3} \cdot \text{ach}_{sg} \cdot \texttt{choose\_goal}_{sg,s}$$

  $\alpha_{G3} = 0.80$, ach_{sg} from `SprintGoal.achievement_status`.

- **G4 minimize_blocker_severity**:

$$\min \sum_{bl \in BL} \alpha_{G4} \cdot \text{sev}_{bl} \cdot (1 - \texttt{mitigate\_blocker}_{bl})$$

  $\alpha_{G4} = 0.90$, sev_{bl} from `Blocker.severity`.

- **G5 minimize_task_effort**:

$$\min \sum_{tsk \in TSK} \sum_{w \in W} \alpha_{G5} \cdot \text{eff}_{tsk} \cdot \texttt{assign\_task}_{tsk,w}$$

  $\alpha_{G5} = 0.60$, eff_{tsk} from `Task.effort`.

- **G6 maximize_story_points_scheduled**:

$$\max \sum_{us \in US} \sum_{s \in SP} \alpha_{G6} \cdot \mathrm{sp}_{us} \cdot \texttt{schedule\_story}_{us,s}$$

$\alpha_{G6} = 1.00$, sp_{us} from `UserStory.story_points`.

- **G7 maximize_team_satisfaction**:

$$\max \sum_{s \in SP} \alpha_{G7} \cdot \mathrm{sat}_s$$

with $\alpha_{G7} = 0.70$, sat_s from `SprintRetrospective.team_satisfaction`.

- **G8 minimize_scrum_board_cards**:

$$\min \sum_{scb \in SCB} \alpha_{G8} \cdot \mathrm{cards}_{scb}$$

$\alpha_{G8} = 0.50$, cards_{scb} from `ScrumBoard.number_of_cards`.

- **G9 minimize_daily_scrum_duration**:

$$\min \sum_{ds \in DS} \alpha_{G9} \cdot \texttt{setup\_daily\_scrum\_duration}_{ds}$$

$\alpha_{G9} = 0.30$.

- **G10 maximize_feature_documentation_links**:

$$\max \sum_{fed \in FED} \alpha_{G10} \cdot \mathrm{links}_{fed}$$

$\alpha_{G10} = 0.20$, links_{fed} from `FeatureDocumentation.linked_requirements` (normalized count).

- **G11 maximize_deployment_target_coverage**:

$$\max \sum_{dev \in DEV} \alpha_{G11} \cdot \mathrm{depCov}_{dev}$$

$\alpha_{G11} = 0.20$, depCov_{dev} derived from `DevelopmentSnapshot.deployment_target`.

- **G12 maximize_sprint_review_feedback**:

$$\max \sum_{sr \in SR} \alpha_{G12} \cdot \mathrm{fb}_{sr}$$

$\alpha_{G12} = 0.35$, fb_{sr} from `SprintReview.feedback_documentation`.

4 Conditions

- **C0 limit_budget_by_project** (Must-match):

$$\sum_{p \in P} \texttt{budget\_spent}_p \leq \sum_{p \in P} \mathrm{budget}_p$$

where budget_p is `Project.budget`.

- **C1 respect_worker_availability** (Must-match):

$$\forall w \in W: \quad \sum_{s \in SP} \texttt{allocate\_effort}_{w,s} \leq \text{avail}_w$$

  avail_w from `Worker.availability`.

- **C2 cap_sprint_backlog_total_effort** (Must-match):

$$\forall s \in SP: \quad \sum_{us \in US} \text{sp}_{us} \cdot \texttt{schedule\_story}_{us,s} \leq \text{capSB}_s$$

  capSB_s from `SprintBacklog.total_effort`.

- **C3 at_most_one_sprint_goal_per_sprint** (Must-match):

$$\forall s \in SP: \quad \sum_{sg \in SG} \texttt{choose\_goal}_{sg,s} \leq 1$$

- **C4 block_unresolved_blockers** (Cannot-match):

$$\forall tsk \in TSK: \quad \sum_{w \in W} \texttt{assign\_task}_{tsk,w} \leq \sum_{bl \in BL} \text{R\_taskBlocked}(tsk, bl) \cdot \texttt{mitigate\_blocker}_{bl}$$

  i.e., a task can be assigned only if its active blockers are mitigated.

- **C5 daily_scrum_max_15_minutes** (Must-match):

$$\forall ds \in DS: \quad \texttt{setup\_daily\_scrum\_duration}_{ds} \leq 15$$

- **C6 maintain_active_product_backlog** (Must-match):

$$\forall pb \in PB: \quad \text{status}_{pb} = \text{“active”}$$

- **C7 release_within_roadmap_window** (Must-match):

$$\forall rep \in REP: \quad \text{plannedDate}_{rep} \leq \text{endDate}_{RM(rep)}$$

  linking `ReleasePlan.planned_date` with `Roadmap.end_date`.

- **C8 sprint_review_attendees_cap** (Must-match):

$$\forall sr \in SR: \quad \text{attendees}_{sr} \leq \overline{A}$$

  with $\overline{A}$ a management cap; `SprintReview.attendees_count`.

- **C9 documentation_required_for_selected_features** (Must-match):

$$\forall f \in F: \quad \texttt{select\_feature}_f \Rightarrow \sum_{fed \in FED(f)} 1 \geq 1$$

- **C10 team_size_capacity_respected** (Must-match):

$$\forall t \in T, p \in P: \quad \texttt{select\_team\_for\_project}_{t,p} \cdot \underline{m} \leq \text{teamSize}_t$$

  where $\underline{m}$ is the minimum required staffing; `Team.team_size`.

- **C11 velocity_capacities_applied** (Must-match):

$$\forall s \in SP: \quad \texttt{story\_points\_committed}_s \leq \sum_{vel \in VEL(s)} \text{avgsp}_{vel}$$

- **C12 track_sprint_backlog_status** (Must-match):

$$\forall s \in SP: \quad \text{status}_{sbl(s)} = \text{“active”}$$

5 DecisionVariables

- Binary $x_{us,s} = \texttt{schedule\_story}_{us,s}$ (DV0)
- Binary $y_{tsk,w} = \texttt{assign\_task}_{tsk,w}$ (DV1)
- Binary $z_{rep,f} = \texttt{include\_feature}_{rep,f}$ (DV2)
- Binary $m_{bl} = \texttt{mitigate\_blocker}_{bl}$ (DV3)
- Binary $a_s = \texttt{activate\_sprint}_s$ (DV4)
- Continuous $q_{w,s} = \texttt{allocate\_effort}_{w,s} \in [0, 1]$ (DV5)
- Continuous $b_p = \texttt{budget\_spent}_p \in [0, 1]$ (DV6)
- Integer $c_s = \texttt{story\_points\_committed}_s \in \mathbb{Z}_{\geq 0}$ (DV7)
- Binary $d_s = \texttt{deploy\_snapshot}_s$ (DV8)
- Binary $g_{sg,s} = \texttt{choose\_goal}_{sg,s}$ (DV9)
- Binary $u_{t,p} = \texttt{select\_team\_for\_project}_{t,p}$ (DV10)
- Integer $h_{ds} = \texttt{setup\_daily\_scrum\_duration}_{ds} \in [0, 30]$ (DV11)
- Binary $r_f = \texttt{select\_feature}_f$ (DV12)