SCRUM Planning Optimization Model

TruelyMostWanted

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Contents

1 1. Sets (Entities)

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

- *Relation sets (from Relationships.csv)*:
  $R1 : T \to P$, $R2 : W \to T$, $R3 : W \to S$, $R4 : W \to R$, $R5 : PO \to PB$, $R6 : T \leftrightarrow SM$, $R7 : PB \to F$, $R8 : PB \to E$, $R9 : E \to US$, $R10 : US \to TSK$, $R11 : US \to SBL$, $R12 : SBL \to SP$, $R13 : SP \to SG$, $R14 : SCB \to TSK$, $R15 : FED \to F$, $R16 : TSK \to BL$, $R17 : SH \to SR$, $R18 : SM \to SRE$, $R19 : VEL \to T$, $R20 : REP \to F$, $R21 : REP \to RM$, $R22 : SP \to DEV$.

2 2. Indices

- $p \in P,\ t \in T,\ w \in W,\ f \in F,\ s \in S,\ r \in R,\ po \in PO,\ sm \in SM,$
- $pb \in PB,\ sp \in SP,\ sbl \in SBL,\ sg \in SG,\ e \in E,\ us \in US,\ tsk \in TSK,$
- $bl \in BL,\ sr \in SR,\ scb \in SCB,\ vel \in VEL.$

Parameters (from entity attributes).

- $budget_p$ (Project.budget), $teamSize_t$ (Team.team_size).
- $priority_f$ (Feature.priority), $effort_{tsk}$ (Task.effort).
- $storyPts_{us}$ (UserStory.story_points).
- $entries_{pb}$ (ProductBacklog.number_of_entries).
- $benefit_{sg}$ (SprintGoal.benefit), $achieve_{sp}$ (Sprint.achievement_of_goal).
- sat aggregated per team/sprint from retrospectives (SprintRetrospective.team_satisfaction).
- sev_{bl} (Blocker.severity).
- $\overline{vel}_t$ velocity linked via $R19$ (Velocity.avg._story_points for team t).
- $attend_{sr}$ (SprintReview.attendees_count).

3 3. Goals

We consider a (potentially) multi-objective model. Each goal Gk is listed with its ID, name, and mathematical form. In practice one may (i) optimize lexicographically, or (ii) use a weighted sum $\max Z = \sum_k w_k \cdot \mathrm{obj}_k$ where w_k are the CSV weights and minimization targets appear with a negative sign.

- **G0 maximize_story_points_completed**:

$$\max \sum_{us \in US} \sum_{sbl \in SBL} storyPts_{us}\, x^{USBL}_{us,sbl}.$$

- **G1 minimize_total_task_effort**:

$$\min \sum_{tsk \in TSK} effort_{tsk}.$$

- **G2 minimize_open_blocker_severity**:

$$\min \sum_{tsk \in TSK} \sum_{bl \in BL} sev_{bl}\ x^{TBL}_{tsk,bl}.$$

- **G3 maximize_average_velocity** (prefer loading higher-velocity teams):

$$\max \sum_{t \in T} \sum_{p \in P} \overline{vel}_t\ x^{TP}_{t,p}.$$

- **G4 maximize_sprint_goal_achievement**:

$$\max \sum_{sp \in SP} \sum_{sg \in SG} achieve_{sp}\ x^{SPSG}_{sp,sg}.$$

- **G5 maximize_team_satisfaction** (proxy aggregated from retrospectives):

$$\max \sum_{t \in T} sat_t.$$

- **G6 minimize_project_budget** (budget of projects we activate by staffing them):

$$\min \sum_{t \in T} \sum_{p \in P} budget_p\ x^{TP}_{t,p}.$$

- **G7 maximize_sprint_goal_benefit**:

$$\max \sum_{sp \in SP} \sum_{sg \in SG} benefit_{sg}\ x^{SPSG}_{sp,sg}.$$

- **G8 maximize_review_attendance**:

$$\max \sum_{sh \in SH} \sum_{sr \in SR} x^{SHSR}_{sh,sr}.$$

- **G9 minimize_sprint_backlog_tasks**:

$$\min \sum_{sbl \in SBL} \text{number\_of\_tasks}_{sbl}.$$

- **G10 maximize_feature_priority_delivered**:

$$\max \sum_{pb \in PB} \sum_{f \in F} priority_f\ x^{BF}_{pb,f}.$$

- **G11 maximize_documentation_linkage** (proxy for documentation coverage):

$$\max \sum_{fed \in FED} \text{linked\_requirements}_{fed}.$$

4 4. Conditions

Each condition Ck is listed with ID, name, and constraint(s).

- **C0 worker_one_team:** $\sum_{t \in T} x_{w,t}^{WT} \leq 1 \quad \forall w \in W.$
- **C1 team_capacity_by_size:** $\sum_{w \in W} x_{w,t}^{WT} \leq teamSize_t \quad \forall t \in T.$
- **C2 us_has_at_least_one_task:** $\sum_{tsk \in TSK} x_{us,tsk}^{UST} \geq 1 \quad \forall us \in US.$
- **C3 us_at_most_one_sbl:** $\sum_{sbl \in SBL} x_{us,sbl}^{USBL} \leq 1 \quad \forall us \in US.$
- **C4 sbl_exactly_one_sprint:** $\sum_{sp \in SP} x_{sbl,sp}^{SBLSP} = 1 \quad \forall sbl \in SBL.$
- **C5 sprint_exactly_one_goal:** $\sum_{sg \in SG} x_{sp,sg}^{SPSG} = 1 \quad \forall sp \in SP.$
- **C6 backlog_has_one_product_owner:** $\sum_{po \in PO} x_{po,pb}^{PO} = 1 \quad \forall pb \in PB.$
- **C7 sm_supports_at_most_one_team:** $\sum_{t \in T} x_{sm,t}^{SMT} \leq 1 \quad \forall sm \in SM.$
- **C8 team_at_most_one_project:** $\sum_{p \in P} x_{t,p}^{TP} \leq 1 \quad \forall t \in T.$
- **C9 task_at_most_one_blocker:** $\sum_{bl \in BL} x_{tsk,bl}^{TBL} \leq 1 \quad \forall tsk \in TSK.$
- **C10 feature_exactly_one_backlog:** $\sum_{pb \in PB} x_{pb,f}^{BF} = 1 \quad \forall f \in F.$
- **C11 epic_has_at_least_one_user_story:** $\sum_{us \in US} x_{e,us}^{EU} \geq 1 \quad \forall e \in E.$
- **C12 backlog_feature_entries_limit:** $\sum_{f \in F} x_{pb,f}^{BF} \leq entries_{pb} \quad \forall pb \in PB.$
- **C13 role_assignment_requires_skill:** $x_{w,r}^{WR} \leq \sum_{s \in S} x_{w,s}^{WS} \quad \forall w \in W, \forall r \in R.$

5 5. DecisionVariables

- $x_{t,p}^{TP} \in \{0,1\}$ (DV0) — *assign_team_to_project.*
- $x_{w,t}^{WT} \in \{0,1\}$ (DV1) — *assign_worker_to_team.*
- $x_{w,s}^{WS} \in \{0,1\}$ (DV2) — *worker_has_skill.*

- $x_{w,r}^{WR} \in \{0,1\}$ (DV3) — *worker_takes_role*.
- $x_{po,pb}^{PO} \in \{0,1\}$ (DV4) — *po_manages_backlog*.
- $x_{sm,t}^{SMT} \in \{0,1\}$ (DV5) — *sm_supports_team*.
- $x_{pb,f}^{BF} \in \{0,1\}$ (DV6) — *backlog_contains_feature*.
- $x_{e,us}^{EU} \in \{0,1\}$ (DV7) — *epic_contains_user_story*.
- $x_{us,sbl}^{USBL} \in \{0,1\}$ (DV8) — *user_story_in_sprint_backlog*.
- $x_{sbl,sp}^{SBLSP} \in \{0,1\}$ (DV9) — *sprint_backlog_in_sprint*.
- $x_{sp,sg}^{SPSG} \in \{0,1\}$ (DV10) — *sprint_pursues_goal*.
- $x_{scb,tsk}^{SCT} \in \{0,1\}$ (DV11) — *scrum_board_contains_task*.
- $x_{tsk,bl}^{TBL} \in \{0,1\}$ (DV12) — *task_blocked_by*.
- $x_{sh,sr}^{SHSR} \in \{0,1\}$ (DV13) — *stakeholder_participates_in_review*.
- $x_{us,tsk}^{UST} \in \{0,1\}$ (DV14) — *user_story_has_task*.