Optimization Model for Scrum-based Software Development

Generated by Meta AI

September 5, 2025

Contents

1 Sets (Entities)

- Project (P)
- Team (T)
- Worker (W)
- Feature (F)
- Skill (S)
- Role (R)
- ProductOwner (PO)
- ScrumMaster (SM)
- ProductBacklog (PB)
- Sprint (SP)
- SprintPlanning (SPP)
- DailyScrum (DS)

- SprintReview (SR)

- SprintRetrospective (SRE)

- SprintBacklog (SBL)

- SprintGoal (SG)

- Epic (E)

- UserStory (US)

- Task (TSK)

- DevelopmentSnapshot (DEV)

- Blocker (BL)

- Stakeholder (SH)

- Velocity (VEL)

- ReleasePlan (REP)

- Roadmap (RM)

- ScrumBoard (SCB)

- FeatureDocumentation (FED)

2 Indices

- $p \in P$ (Project)

- $t \in T$ (Team)

- $w \in W$ (Worker)

- $f \in F$ (Feature)

- $s \in S$ (Skill)

- $r \in R$ (Role)

- $po \in PO$ (ProductOwner)

- $sm \in SM$ (ScrumMaster)

- $pb \in PB$ (ProductBacklog)

- $sp \in SP$ (Sprint)

- $sg \in SG$ (SprintGoal)

- $e \in E$ (Epic)

- $us \in US$ (UserStory)

- $tsk \in TSK$ (Task)

- $dev \in DEV$ (DevelopmentSnapshot)

- $bl \in BL$ (Blocker)

- $sh \in SH$ (Stakeholder)

- $vel \in VEL$ (Velocity)

- $rep \in REP$ (ReleasePlan)

- $rm \in RM$ (Roadmap)

- $scb \in SCB$ (ScrumBoard)

- $fed \in FED$ (FeatureDocumentation)

3 Goals

- G_0: maximize_team_velocity Maximize $\sum_{t \in T} vel_t \cdot avg\_story\_points_t$
  $Subject to \quad vel_t \in \{0, 1, 2, ..., 100\} \quad \forall t \in T$

- G_1: minimize_blocker_severity Minimize $\sum_{bl \in BL} severity_{bl}$
  $Subject to \quad severity_{bl} \in \{0, 1, 2, ..., 10\} \quad \forall bl \in BL$

- G_2: maximize_sprint_goal_achievement Maximize $\sum_{sp \in SP} achievement\_status_{sp}$
  $Subject to \quad achievement\_status_{sp} \in \{0, 1\} \quad \forall sp \in SP$

- G_3: minimize_task_effort Minimize $\sum_{tsk \in TSK} effort_{tsk}$
  $Subject to \quad effort_{tsk} \in \{0, 1, 2, ..., 100\} \quad \forall tsk \in TSK$

- G_4: maximize_feature_priority Maximize $\sum_{f \in F} priority_f$
  $Subject to \quad priority_f \in \{0, 1, 2, ..., 10\} \quad \forall f \in F$

- G_5: minimize_sprint_retrospective_improvement_actions Minimize $\sum_{sre \in SRE} improvement\_actions_{sre}$
  $Subject to \quad improvement\_actions_{sre} \in \{0, 1, 2, ..., 10\} \quad \forall sre \in SRE$

- G_6: maximize_product_owner_availability Maximize $\sum_{po \in PO} availability_{po}$
  $Subject to \quad availability_{po} \in \{0, 1, 2, ..., 100\} \quad \forall po \in PO$

- G_7: minimize_task_blockers Minimize $\sum_{tsk \in TSK} blockers_{tsk}$
  $Subject to \quad blockers_{tsk} \in \{0, 1\} \quad \forall tsk \in TSK$

- G_8: maximize_scrum_master_experience Maximize $\sum_{sm \in SM} experience_{sm}$
  $Subject to \quad experience_{sm} \in \{0, 1, 2, ..., 10\} \quad \forall sm \in SM$

- G_9: minimize_development_snapshot_bugs Minimize $\sum_{dev \in DEV} bugs_{dev}$
  $Subject to \quad bugs_{dev} \in \{0, 1, 2, ..., 10\} \quad \forall dev \in DEV$

- G_{10}: maximize_stakeholder_satisfaction Maximize $\sum_{sh \in SH} satisfaction_{sh}$
  $Subject to \quad satisfaction_{sh} \in \{0, 1, 2, ..., 10\} \quad \forall sh \in SH$

- G_{11}: minimize_release_plan_delay Minimize $\sum_{rep \in REP} delay_{rep}$
  $Subject to \quad delay_{rep} \in \{0, 1, 2, ..., 10\} \quad \forall rep \in REP$

- G_{12}: maximize_team_collaboration Maximize $\sum_{t \in T} collaboration_t$
  $Subject to \quad collaboration_t \in \{0, 1, 2, ..., 10\} \quad \forall t \in T$

- G_{13}: minimize_product_backlog_debt Minimize $\sum_{pb \in PB} debt_{pb}$
  $Subject to \quad debt_{pb} \in \{0, 1, 2, ..., 10\} \quad \forall pb \in PB$

- G_{14}: maximize_feature_documentation_quality Maximize $\sum_{fed \in FED} quality_{fed}$
  $Subject to \quad quality_{fed} \in \{0, 1, 2, ..., 10\} \quad \forall fed \in FED$

4 Conditions

- C_0: team_has_scrum_master $\sum_{t \in T} sm_t \geq 1$
  $sm_t \in \{0, 1\} \quad \forall t \in T$

- C_1: product_owner_is_available $\sum_{po \in PO} availability_{po} \geq 1$
  $availability_{po} \in \{0, 1, 2, ..., 100\} \quad \forall po \in PO$

- C_2: sprint_goal_is_defined $\sum_{sp \in SP} objective\_description_{sp} \geq 1$
  $objective\_description_{sp} \in \{0, 1\} \quad \forall sp \in SP$

- C_3: task_is_blocked $\sum_{tsk \in TSK} blockers_{tsk} \leq 1$
  $blockers_{tsk} \in \{0, 1\} \quad \forall tsk \in TSK$

- C_4: feature_has_high_priority $\sum_{f \in F} priority_f \geq 5$
  $priority_f \in \{0, 1, 2, ..., 10\} \quad \forall f \in F$

- C_5: sprint_retrospective_improvement_actions_are_defined $\sum_{sre \in SRE} improvement\_actions_{sre} \geq 1$
  $improvement\_actions_{sre} \in \{0, 1, 2, ..., 10\} \quad \forall sre \in SRE$

- C_6: development_snapshot_is_tested $\sum_{dev \in DEV} test\_status_{dev} \geq 1$
  $test\_status_{dev} \in \{0, 1\} \quad \forall dev \in DEV$

- C_7: stakeholder_is_satisfied $\sum_{sh \in SH} satisfaction_{sh} \geq 5$
  $satisfaction_{sh} \in \{0, 1, 2, ..., 10\} \quad \forall sh \in SH$

- C_8: release_plan_is_defined $\sum_{rep \in REP} planned\_date_{rep} \geq 1$
  $planned\_date_{rep} \in \{0, 1\} \quad \forall rep \in REP$

- C_9: team_is_collaborative $\sum_{t \in T} collaboration_t \geq 5$
  $collaboration_t \in \{0, 1, 2, ..., 10\} \quad \forall t \in T$

- C_{10}: product_backlog_is_managed $\sum_{pb \in PB} number\_of\_entries_{pb} \geq 1$
  $number\_of\_entries_{pb} \in \{0, 1, 2, ..., 100\}$ $\quad \forall pb \in PB$

- C_{11}: feature_documentation_is_available $\sum_{fed \in FED} title_{fed} \geq 1$
  $title_{fed} \in \{0, 1\}$ $\quad \forall fed \in FED$

- C_{12}: scrum_master_has_experience $\sum_{sm \in SM} experience_{sm} \geq 5$
  $experience_{sm} \in \{0, 1, 2, ..., 10\}$ $\quad \forall sm \in SM$

- C_{13}: task_is_assigned_to_team $\sum_{tsk \in TSK} team\_assignment_{tsk} \geq 1$
  $team\_assignment_{tsk} \in \{0, 1\}$ $\quad \forall tsk \in TSK$

- C_{14}: sprint_backlog_is_defined $\sum_{sbl \in SBL} number\_of\_tasks_{sbl} \geq 1$
  $number\_of\_tasks_{sbl} \in \{0, 1, 2, ..., 100\}$ $\quad \forall sbl \in SBL$

5 Decision Variables

- D_0: team_velocity $\in \{0, 1, 2, ..., 100\}$

- D_1: blocker_severity $\in \{0, 1, 2, ..., 10\}$

- D_2: sprint_goal_achievement $\in \{0, 1\}$

- D_3: task_effort $\in \{0, 1, 2, ..., 100\}$

- D_4: feature_priority $\in \{0, 1, 2, ..., 10\}$

- D_5: sprint_retrospective_improvement_actions $\in \{0, 1, 2, ..., 10\}$

- D_6: product_owner_availability $\in \{0, 1, 2, ..., 100\}$

- D_7: task_blockers $\in \{0, 1\}$

- D_8: scrum_master_experience $\in \{0, 1, 2, ..., 10\}$

- D_9: development_snapshot_bugs $\in \{0, 1, 2, ..., 10\}$

- D_{10}: stakeholder_satisfaction $\in \{0, 1, 2, ..., 10\}$

- D_{11}: release_plan_delay $\in \{0, 1, 2, ..., 10\}$

- D_{12}: team_collaboration $\in \{0, 1, 2, ..., 10\}$

- D_{13}: product_backlog_debt $\in \{0, 1, 2, ..., 10\}$

- D_{14}: feature_documentation_quality $\in \{0, 1, 2, ..., 10\}$