Optimization Model for Software Development using Scrum

Generated Model

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 index)

- $t \in T$ (Team index)

- $w \in W$ (Worker index)

- $f \in F$ (Feature index)

- $s \in S$ (Skill index)

- $r \in R$ (Role index)

- $sp \in SP$ (Sprint index)

- $us \in US$ (User Story index)

- $tsk \in TSK$ (Task index)

3 Goals

- G0: maximize_team_velocity $\max \sum_{t \in T} VEL_t.avg\_story\_points$
- G1: minimize_blocker_severity $\min \sum_{bl \in BL} BL_{bl}.severity$
- G2: maximize_sprint_goal_achievement $\max \sum_{sp \in SP} SG_{sp}.achievement\_status$
- G3: minimize_task_effort $\min \sum_{tsk \in TSK} TSK_{tsk}.effort$
- G4: maximize_feature_priority $\max \sum_{f \in F} F_f.priority$
- G5: minimize_project_duration $\min P_p.project\_end - P_p.project\_start$
- G6: maximize_stakeholder_satisfaction $\max \sum_{sh \in SH} SH_{sh}.influence\_level$
- G7: minimize_development_snapshot_bugs $\min \sum_{dev \in DEV} DEV_{dev}.test\_status$
- G8: maximize_scrum_board_productivity $\max \sum_{scb \in SCB} SCB_{scb}.number\_of\_cards$
- G9: minimize_sprint_retrospective_improvement_actions $\min \sum_{sre \in SRE} SRE_{sre}.improvement\_action$
- G10: maximize_product_backlog_quality $\max PB_{pb}.status$
- G11: minimize_task_blockers $\min \sum_{tsk \in TSK} TSK_{tsk}.blockers$
- G12: maximize_team_collaboration $\max \sum_{t \in T} T_t.team\_size$
- G13: minimize_project_cost $\min P_p.budget$
- G14: maximize_feature_documentation_quality $\max \sum_{fed \in FED} FED_{fed}.title$

4 Conditions

- C0: team_size_condition $T_t.team\_size \geq 1, \forall t \in T$
- C1: project_status_condition $P_p.status = "active", \forall p \in P$
- C2: feature_priority_condition $F_f.priority \geq 1, \forall f \in F$
- C3: task_status_condition $TSK_{tsk}.status \in \{"in\_progress", "done"\}, \forall tsk \in TSK$
- C4: sprint_goal_condition $SG_{sp}.achievement\_status = "achieved", \forall sp \in SP$
- C5: blocker_severity_condition $BL_{bl}.severity \leq 2, \forall bl \in BL$
- C6: stakeholder_influence_condition $SH_{sh}.influence\_level \geq 1, \forall sh \in SH$
- C7: development_snapshot_condition $DEV_{dev}.test\_status = "passed", \forall dev \in DEV$

- C8: scrum_board_productivity_condition $SCB_{scb}.number\_of\_cards \geq 1, \forall scb \in SCB$

- C9: sprint_retrospective_condition $SRE_{sre}.improvement\_actions \leq 2, \forall sre \in SRE$

- C10: product_backlog_condition $PB_{pb}.status = "up-to-date", \forall pb \in PB$

- C11: task_blocker_condition $TSK_{tsk}.blockers = 0, \forall tsk \in TSK$

- C12: team_collaboration_condition $T_t.team\_size \geq 2, \forall t \in T$

- C13: project_cost_condition $P_p.budget \geq 1000, \forall p \in P$

- C14: feature_documentation_condition $FED_{fed}.title \neq "", \forall fed \in FED$

5 Decision Variables

- D0: team_size (x_t) $x_t \in Z^+, \forall t \in T$

- D1: project_duration $(d \in D)$ $d \in Z^+, \forall p \in P$

- D2: feature_priority (x_f) $x_f \in \{1, 2, 3\}, \forall f \in F$

- D3: task_effort (x_{tsk}) $x_{tsk} \in Z^+, \forall tsk \in TSK$

- D4: sprint_goal_achievement (x_{sp}) $x_{sp} \in \{0, 1\}, \forall sp \in SP$

- D5: blocker_severity (x_{bl}) $x_{bl} \in \{1, 2, 3\}, \forall bl \in BL$

- D6: stakeholder_influence (x_{sh}) $x_{sh} \in \{1, 2, 3\}, \forall sh \in SH$

- D7: development_snapshot_quality (x_{dev}) $x_{dev} \in \{1, 2, 3\}, \forall dev \in DEV$

- D8: scrum_board_productivity (x_{scb}) $x_{scb} \in Z^+, \forall scb \in SCB$

- D9: sprint_retrospective_improvement_actions (x_{sre}) $x_{sre} \in Z^+, \forall sre \in SRE$

- D10: product_backlog_quality (x_{pb}) $x_{pb} \in \{1, 2, 3\}, \forall pb \in PB$

- D11: task_blockers (x_{tsk}) $x_{tsk} \in Z^+, \forall tsk \in TSK$

- D12: team_collaboration (x_t) $x_t \in \{1, 2, 3\}, \forall t \in T$

- D13: project_cost (x_p) $x_p \in Z^+, \forall p \in P$

- D14: feature_documentation_quality (x_{fed}) $x_{fed} \in \{1, 2, 3\}, \forall fed \in FED$