Optimization Model for SCRUM-based Software Development

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Entities

Let the following sets represent core entities in the model:

- P: Set of Projects
- T: Set of Teams
- E: Set of Employees
- F: Set of Features
- S: Set of Skills
- R: Set of Roles
- PO: Set of Product Owners
- SM: Set of Scrum Masters
- PB: Set of Product Backlogs
- SP: Set of Sprints
- EP: Set of Epics
- US: Set of User Stories
- TS: Set of Tasks / Sub-Tasks
- BL: Set of Blockers
- SH: Set of Stakeholders
- V: Set of Velocity records

Decision Variables

$$x_{e,t} = \begin{cases} 1 & \text{if employee } e \in E \text{ is assigned to team } t \in T \\ 0 & \text{otherwise} \end{cases}$$

$$y_{us,sp} = \begin{cases} 1 & \text{if user story } us \in US \text{ is assigned to sprint } sp \in SP \\ 0 & \text{otherwise} \end{cases}$$

$$a_{ts,e} = \begin{cases} 1 & \text{if task } ts \in TS \text{ is assigned to employee } e \in E \\ 0 & \text{otherwise} \end{cases}$$

$v_t \in \mathbb{Z}^+$ — Velocity of team $t \in T$

$b_p \in \mathbb{R}^+$ — Budget allocated to project $p \in P$

$d_{sp} \in \mathbb{Z}^+$ — Duration of sprint $sp \in SP$

$\alpha_e \in [0, 1]$ — Availability of employee $e \in E$

Objective Function

Maximize overall project efficiency:

$$\max \quad \sum_{t \in T} v_t - \sum_{p \in P} b_p - \sum_{bl \in BL} \text{severity}_{bl}$$

Constraints

$\sum_{e \in E} x_{e,t} \leq 9 \quad \forall t \in T$	(C1: Team Size Limit)
$a_{ts,e} \leq \text{skill\_match}(ts, e) \quad \forall ts \in TS, e \in E$	(C2: Skill Matching)
$\sum_{sp \in SP_p} 1 \leq 8 \quad \forall p \in P$	(C3: Max Sprints per Project)
$\text{sprint\_goal\_defined}(sp) = 1 \quad \forall sp \in SP$	(C4: Sprint Goal Alignment)
$\text{daily\_scrum\_duration} \leq 15$	(C5: Daily Scrum Duration Limit)
$\text{effort}_{ts} \leq 8 \quad \forall ts \in TS$	(C6: Task Effort Limit)
$a_{ts,e} \leq \alpha_e \quad \forall ts \in TS, e \in E$	(C7: Employee Availability)
$\text{moderated}(retro) = 1 \quad \forall retro \in \text{Retrospectives}$	(C8: Retrospective Moderation)
$\text{doc\_linked}(f) = 1 \quad \forall f \in F$	(C9: Documentation Completeness)
$\text{resolve\_time}(bl) \leq 3 \quad \forall bl \in BL$	(C10: Blocker Resolution Time)

Notes

- Constraints and objective functions are aligned with goals and conditions, ensuring optimal SCRUM process efficiency.
- Each variable and constraint corresponds to a real-world relationship or attribute in the domain model.