

Optimization Model for SCRUM-based Software Development

Sets and Indices

- $s \in S$: set of Sprints
- $t \in T$: set of Tasks
- $e \in E$: set of Employees
- $k \in K$: set of Skills
- $f \in F$: set of Features
- $b \in B$: set of Blockers
- $r \in R$: set of Roles

Parameters

effort_t : Estimated effort for task t
 availability_e : Availability percentage of employee e
 $\text{skillLevel}_{e,k}$: Skill level of employee e for skill k
 severity_b : Severity of blocker b
 storyPoints_s : Planned story points in sprint s
 maxTeamSize : Maximum allowed team size
 minSkillLevel : Minimum skill level required
 $\text{blockerSeverityThreshold}$: Severity threshold for critical blockers

Decision Variables

$x_{t,s} \in \{0, 1\}$: 1 if task t is assigned in sprint s , 0 otherwise
 $y_{e,t} \in \{0, 1\}$: 1 if employee e is assigned to task t , 0 otherwise
 z_s : Total story points completed in sprint s
 $d_b \in \{0, 1\}$: 1 if blocker b is resolved, 0 otherwise

Objective Functions

$\max \sum_{s \in S} z_s$	(Maximize Sprint Velocity)
$\min \sum_{b \in B} (1 - d_b) \cdot \text{resolutionTime}_b$	(Minimize Blocker Resolution Time)
$\max \sum_{e \in E} \sum_{t \in T} y_{e,t} \cdot \text{availability}_e$	(Maximize Team Utilization)
$\min \sum_{t \in T} \text{effort}_t - \text{actualEffort}_t $	(Minimize Task Effort Overrun)
$\max \sum_{f \in F} \text{includedInSprint}_f$	(Maximize Backlog Coverage)

Constraints

$\sum_{e \in E} y_{e,t} \geq 1, \quad \forall t \in T$	(Each task assigned to at least one employee)
$\sum_{t \in T} y_{e,t} \cdot \text{effort}_t \leq \text{availability}_e \cdot \text{SprintDuration}, \quad \forall e \in E$	(Respect employee availability)
$\sum_{t \in T} x_{t,s} \cdot \text{storyPoints}_t \leq \text{maxSprintCapacity}_s, \quad \forall s \in S$	(Sprint capacity limits)
$\sum_{e \in E} \text{role}_{e,r} \geq \text{requiredRoleCount}_r, \quad \forall r \in R$	(Role coverage constraints)
$\text{skillLevel}_{e,k} \geq \text{minSkillLevel}, \quad \text{if } y_{e,t} = 1 \text{ and task } t \text{ requires skill } k$	(Minimum skill level)
$\sum_{b \in B: \text{severity}_b \geq \text{blockerSeverityThreshold}} (1 - d_b) = 0$	(Critical blockers must be resolved)
$\sum_{e \in E} \text{teamMembers}_e \leq \text{maxTeamSize}$	(Team size limit)