Optimization Model for Scrum-Based Software Development

Sets and Indices

$t \in T$	Teams
$p \in P$	Projects
$e \in E$	Employees
$s \in S$	Sprints
$f \in F$	Features
$u \in U$	User Stories
$k \in K$	Tasks (Sub-Tasks)
$b \in B$	Blockers
$r \in R$	Roles
$sk \in SK$	Skills

Decision Variables

$x_{k,s} \in \mathbb{Z}_{\geq 0}$	Number of tasks k assigned in sprint s
$y_{e,k} \in \{0,1\}$	Employee e assigned to task k
$d_s \in \mathbb{Z}$	Duration (days) of sprint s
$B_p \in \mathbb{R}_{\geq 0}$	Budget allocation to project p
$sp_s \in \mathbb{Z}_{\geq 0}$	Story points planned in sprint s
$l_{e,sk} \in \mathbb{Z}$	Skill level of employee e for skill sk
$m_s \in \mathbb{Z}_{\geq 0}$	Max blockers allowed in sprint s
$ts_t \in \mathbb{Z}_{\geq 0}$	Team size of team t
$mt \in \mathbb{Z}_{\geq 0}$	Meeting duration in minutes
$fc_s \in [0,100]$	Feature completion rate (%) in sprint s

Objective Function

$$\max Z = w_1 \sum_{s \in S} sp_s - w_2 \sum_{s \in S} m_s + w_3 \sum_{e \in E} \sum_{k \in K} y_{e,k} \cdot \text{skillMatch}_{e,k} - w_4 \sum_{p \in P} \max(0, \text{Cost}_p - B_p)$$

where w_1, w_2, w_3, w_4 are weights prioritizing goals.

Constraints

1. **Team assignment to projects:**

$$\forall t \in T, \quad \sum_{p \in P} \text{assigned}(t,p) \geq 1$$

2. **Employee availability:**

$$\forall e \in E, \quad \sum_{k \in K} y_{e,k} \leq \text{availability}_e$$

3. **Role coverage in teams:**

$$\forall t \in T, \forall r \in R, \quad \sum_{e \in E} \text{belongs}(e,t) \cdot \text{takesRole}(e,r) \geq 1$$

4. **Sprint duration limits:**

$$7 \leq d_s \leq 30 \quad \forall s \in S$$

5. **Budget constraints:**

$$\text{Cost}_p \leq B_p \quad \forall p \in P$$

6. **Feature priority scheduling:**

$$\text{If priority}(f_i) > \text{priority}(f_j), \text{ then scheduledSprint}(f_i) \leq \text{scheduledSprint}(f_j)$$

7. **Skill matching:**

$$y_{e,k} = 0 \quad \text{if } l_{e,sk} < \text{skillRequirement}_{k,sk} \quad \forall e, k, sk$$

8. **Maximum team size:**

$$ts_t \leq \text{MaxTeamSize} \quad \forall t \in T$$

9. **Blocker resolution time:**

$$\text{resolveTime}_b \leq d_s \quad \forall b \in B, \text{ if blocker } b \text{ occurs in sprint } s$$

10. **Sprint goal presence:**

$$\forall s \in S, \quad \exists \text{SprintGoal}_s \neq \emptyset$$