

Optimization Model for Scrum-based Software Development

Decision Variables

d_s : Sprint duration in days	$7 \leq d_s \leq 30, \quad d_s \in \mathbb{Z}$
e_t : Effort estimate for task t	$0.5 \leq e_t \leq 40$
n_{team} : Team size	$3 \leq n_{\text{team}} \leq 15, \quad n_{\text{team}} \in \mathbb{Z}$
sp_s : Story points planned in sprint s	$5 \leq sp_s \leq 50, \quad sp_s \in \mathbb{Z}$
l_{sk} : Skill level of skill k	$1 \leq l_{sk} \leq 5, \quad l_{sk} \in \mathbb{Z}$
sev_b : Severity of blocker b	$1 \leq sev_b \leq 10, \quad sev_b \in \mathbb{Z}$
av_e : Availability of employee e	$0 \leq av_e \leq 100$
f_r : Number of features in release r	$1 \leq f_r \leq 20, \quad f_r \in \mathbb{Z}$
n_{sprint} : Number of sprints for velocity calculation	$1 \leq n_{\text{sprint}} \leq 10, \quad n_{\text{sprint}} \in \mathbb{Z}$
c_t : Task t completion status	$c_t \in \{0, 1\}$

Objectives

$\max \sum_s v_s$	(Maximize sprint velocity)
$\min \sum_b \text{bugs}_b$	(Minimize bugs)
$\max \sum_r f_r$	(Maximize features delivered)
$\min \sum_t e_t$	(Minimize total task effort)
$\max \sum_e av_e$	(Maximize team availability)

Constraints

$\forall T, \quad \exists P : \text{assigned}(T, P)$	(Team assigned to at least one project)
$\forall e, \quad \sum_k \text{hasSkill}(e, k) \geq 1$	(Employee has at least one skill)
$\forall e, \quad \sum_r \text{hasRole}(e, r) \geq 1$	(Employee has at least one role)
$\forall T, \quad \sum_{sm} \text{supports}(sm, T) = 1$	(One Scrum Master per team)
$\forall sb, \quad \exists s : \text{belongs}(sb, s)$	(Sprint backlog belongs to sprint)
$\forall f, \quad \text{status}(f) \neq \text{Cancelled}$	(Feature status restriction)
$\forall s, \quad \sum_{t \in sb_s} e_t \leq C_s$	(Task effort within sprint capacity)
$\forall b, \quad sev_b \leq S_{max}$	(Blocker severity limit)
$\forall pb, \quad \text{status}(pb) = \text{Active}$	(Active product backlog)
$\forall t, \quad \text{status}(t) \in \{\text{ToDo}, \text{In Progress}, \text{Done}\}$	(Allowed task statuses)