Optimization Model for Scrum-based Software Development

Sets

S Set of Sprints
P Set of Projects
R Set of Release Plans
F Set of Features
T Set of Teams
E Set of Employees
B Set of Blockers
U Set of User Stories
K Set of Tasks

Decision Variables

x_s^{sp} Allocated story points in sprint s, $s \in S$

$x_{e,s}^h$ Hours employee e works in sprint s, $e \in E,\ s \in S$

x^{n_s} Number of sprints planned for the project

x_r^f Number of features in release plan r, $r \in R$

x_s^k Number of tasks in sprint s, $s \in S$

x_s^b Budget allocated in sprint s, $s \in S$

x_t^d Number of developers in team t, $t \in T$

x_s^q Number of testers in sprint s, $s \in S$

x_f^d Documentation hours for feature f, $f \in F$

x_s^a Retrospective actions in sprint s, $s \in S$

Objectives (Multi-objective)

$$\max Z_1 = \frac{1}{|S|} \sum_{s \in S} x_s^{\text{sp}} \qquad \text{(Maximize average velocity)}$$

$$\min Z_2 = \frac{1}{|S|} \sum_{s \in S} \text{Duration}(s) \qquad \text{(Minimize sprint duration)}$$

$$\max Z_3 = \sum_{r \in R} x_r^f \qquad \text{(Maximize features delivered)}$$

$$\min Z_4 = \frac{1}{|B|} \sum_{b \in B} \text{Severity}(b) \qquad \text{(Minimize average bug severity)}$$

$$\max Z_5 = \frac{1}{|S|} \sum_{s \in S} \frac{\sum_{e \in E} x_{e,s}^h}{|E| \cdot H_{\max}} \qquad \text{(Maximize team utilization)}$$

$$\min Z_6 = \max_{p \in P} (\text{Spent}(p) - \text{Budget}(p)) \qquad \text{(Minimize budget overrun)}$$

$$\max Z_7 = \frac{1}{|S|} \sum_{s \in S} \text{StakeholderScore}(s) \qquad \text{(Maximize stakeholder satisfaction)}$$

$$\min Z_8 = \#\{k \in K : \text{rework}(k)\} \qquad \text{(Minimize task rework)}$$

$$\max Z_9 = |\{r \in R\}| \qquad \text{(Maximize release frequency)}$$

$$\min Z_{10} = \#\{\text{unplanned tasks in } s\} \qquad \text{(Minimize unplanned work)}$$

Constraints

Team Size:	$x_t^d \leq 10 \quad \forall t \in T$	(1)
Sprint Length:	$7 \leq \text{Duration}(s) \leq 30 \quad \forall s \in S$	(2)
Budget Cap:	$\sum_{s \in S} x_s^b \leq \text{Budget}(p) \quad \forall p \in P$	(3)
Skill Coverage:	$\forall f \in F, \ \exists e \in E : \ \text{skill}(e, f) = 1$	(4)
Availability:	$\sum_{s \in S} x_{e,s}^h \leq \text{Availability}(e) \quad \forall e \in E$	(5)
Release Deadline:	$\text{Date}(r) \leq \text{MilestoneDate}(m) \quad \forall r \in R$	(6)
Blocked Task Limit:	$\sum_{k \in K} \mathbf{1}_{\text{blocked}(k,s)} \leq 5 \quad \forall s \in S$	(7)
Daily Scrum Time:	$\text{ScrumDuration}(d) \leq 15 \quad \forall d \in \text{DailyScrums}$	(8)
Backlog Size:	$\text{Size}(\text{PB}) \leq 100$	(9)
Review Attendance:	$\text{Attended}(s) \geq 0.8 \times \text{TotalStakeholders}(s) \quad \forall s \in S$	(10)