SCRUM-Based Software Development Optimization Model

1. Sets and Indices

- P: Set of projects
- T: Set of teams
- E: Set of employees
- F: Set of features
- S: Set of skills
- R: Set of roles
- B: Set of backlogs
- Sp: Set of sprints
- Ts: Set of tasks

2. Parameters

- $avail_e$: Availability score of employee $e \in E$
- $effort_t$: Estimated effort for task $t \in Ts$
- $budget_p$: Budget allocated to project $p \in P$
- $priority_f$: Priority level of feature $f \in F$
- $skill_{es}$: Binary parameter, 1 if employee e has skill s, 0 otherwise
- $certified_{es}$: Binary parameter, 1 if skill s of employee e is certified
- max_team_size: Maximum allowed team size
- $max\_sprint\_duration$: Maximum allowed sprint duration (28 days)
- $velocity_t$: Team velocity

3. Decision Variables

- $x_{et} \in \{0, 1\}$: 1 if employee e is assigned to team t
- $y_{etask} \in \{0, 1\}$: 1 if employee e is assigned to task $task$
- $z_f \in \mathbb{N}$: Budget assigned to feature f
- $w_{sp} \in \mathbb{N}$: Length of sprint sp in days

4. Objective Function

Minimize the total project effort and maximize team utilization and sprint goal achievement:

$$\min \sum_{t \in Ts} effort_t - \alpha \sum_{e \in E, t \in Ts} y_{et} \cdot avail_e + \beta \sum_{sp \in Sp} goal\_achieved_{sp}$$

where α, β are weighting coefficients.

5. Constraints

(C1) Team size limit: $\sum_{e \in E} x_{et} \leq max\_team\_size$ $\forall t \in T$ (1)

(C2) Sprint duration: $w_{sp} \leq max\_sprint\_duration$ $\forall sp \in Sp$ (2)

(C3) Employee availability: $y_{etask} \leq avail_e$ $\forall e \in E, task \in Ts$ (3)

(C4) Certified skills required: $skill_{es} \cdot certified_{es} \geq required_s$ $\forall e, s$ (4)

(C5) One role per employee: $\sum_{r \in R} role_{er} \leq 1$ $\forall e \in E$ (5)

(C6) Feature budget: $z_f \leq budget_p$ $\forall f \in F, p \in P$ (6)

(C7) Task effort capacity: $\sum_{t \in Ts} effort_t \cdot y_{et} \leq velocity_t$ $\forall t \in T$ (7)

(C8) Role-based moderation: $moderator_{retrospective} = scrum\_master$ (8)

(C9) Scrum timing: $scrum\_time \in working\_hours$ (9)

(C10) User Story Task Ratio: $\frac{\text{Tasks}_s}{\text{UserStories}_s} \leq \theta$ $\forall s \in Sp$ (10)

6. Goals Summary

ID	Name	Goal Type
G01	Minimize Project Duration	Min
G02	Maximize Team Utilization	Max
G03	Minimize Task Effort	Min
G04	Maximize Feature Completion Rate	Max
G05	Minimize Number of Blockers	Min
G06	Maximize Stakeholder Satisfaction	Max
G07	Maximize Skill Matching	Max
G08	Minimize Task Switching	Min
G09	Maximize Sprint Goal Achievement	Max
G10	Minimize Budget Usage	Min