

Optimization Model for SCRUM-based Software Development

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1 Entities

We define the following sets and parameters based on the entities in the domain model:

- P - Set of Projects
- T - Set of Teams
- E - Set of Employees
- F - Set of Features
- S - Set of Skills
- R - Set of Roles
- PO - Set of Product Owners
- SM - Set of Scrum Masters
- PB - Set of Product Backlogs
- SP - Set of Sprints
- SB - Set of Sprint Backlogs
- US - Set of User Stories
- TS - Set of Tasks/Sub-Tasks
- G - Set of Sprint Goals
- B - Set of Blockers
- SH - Set of Stakeholders
- V - Set of Velocity records
- RP - Set of Release Plans
- RM - Set of Roadmaps

2 Decision Variables

- $x_{et} \in \{0, 1\}$: Employee $e \in E$ is assigned to team $t \in T$
- $y_{ts} \in \{0, 1\}$: Task $t \in TS$ is assigned to employee $s \in E$
- $v_s \in \mathbb{R}$: Velocity in sprint $s \in SP$
- $d_s \in \mathbb{Z}_+$: Duration of sprint $s \in SP$
- $w_e \in \mathbb{Z}_+$: Weekly hours available for employee $e \in E$
- $b_p \in \mathbb{R}$: Budget for project $p \in P$
- $a_f \in \{0, 1\}$: Feature $f \in F$ is included in the current release

3 Objective Function

Minimize Project Duration

$$\min \sum_{p \in P} \text{ProjectDuration}_p$$

Maximize Feature Coverage

$$\max \sum_{f \in F} a_f$$

Maximize Velocity

$$\max \sum_{s \in SP} v_s$$

Minimize Task Blockers

$$\min \sum_{t \in TS} \text{Blockers}_t$$

Maximize Competency Match

$$\max \sum_{e \in E} \sum_{s \in S} \text{SkillMatch}_{es}$$

4 Constraints

- Team capacity respected:

$$\sum_{e \in E} x_{et} \leq \text{TeamCapacity}_t, \quad \forall t \in T$$

- Employees not over-allocated:

$$\sum_{t \in TS} y_{ts} \cdot \text{Effort}_t \leq w_s, \quad \forall s \in E$$

- Sprint duration constraint:

$$d_s \leq 28, \quad \forall s \in SP$$

- All features must be documented:

$$\text{Documentation}_f \geq 1, \quad \forall f \in F \text{ where } a_f = 1$$

- PO and SM availability:

$$\text{Availability}_{po} \geq \theta, \quad \forall po \in PO$$

$$\text{Moderated}_{sm,r} = 1, \quad \forall sm \in SM, \forall r \in \text{Retrospectives}$$

5 Notes

- Binary and integer constraints apply to all assignment and selection variables.
- All goals are translated into objective functions and soft or hard constraints depending on the criteria type.