SCRUM Portfolio & Sprint Planning Optimization Model

Automatically generated from Entities, Relationships, Goals, Conditions, Decision Variables

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Contents

1 1. Sets (Entities)

- P (Projects, `Project`): attributes {id, name, project_start, project_end, description, budget, status, target_

- T (Teams, `Team`): attributes {id, name, team_size, team_start, team_status, location, team_type}.

- W (Workers, `Worker`): attributes {id, name, first_name, email, start_date, status, availability}.

- F (Features, `Feature`): attributes {id, title, description, status, priority, estimated_effort}.

- S (Skills, `Skill`): attributes {id, label, description, level, certified, category}.

- R (Roles, `Role`): attributes {id, role_name, description, area_of_responsibility}.

- PO (Product Owners, `ProductOwner`): attributes {id, name, email, availability}.

- SM (Scrum Masters, `ScrumMaster`): attributes {id, name, email, experience}.

- PB (Product Backlogs, `ProductBacklog`): attributes {id, created_on, last_updated, number_of_entries, sta

- SP (Sprints, `Sprint`): attributes {id, sprint_number, start_date, end_date, status, achievement_of_goal}.

- SPP (Sprint Plannings, `SprintPlanning`): attributes {id, date, duration_(min), moderation, outcome_doc

- DS (Daily Scrums, `DailyScrum`): attributes {id, date, time, duration, moderation}.

- SR (Sprint Reviews, `SprintReview`): attributes {id, date, duration, feedback_documentation, attendees_co

- SRE (Retrospectives, `SprintRetrospective`): attributes {id, date, duration, improvement_actions, team_

- SBL (Sprint Backlogs, `SprintBacklog`): attributes {id, number_of_tasks, last_updated, status, total_effort

- SG (Sprint Goals, `SprintGoal`): attributes {id, objective_description, achievement_status, benefit}.

- E (Epics, `Epic`): attributes {id, title, description, priority, status, estimated_effort}.

- US (User Stories, `UserStory`): attributes {id, title, description, acceptance_criteria, priority, story_points, s

- TSK (Tasks, `Task`): attributes {id, title, description, status, effort, type}.

- DEV (Development Snapshots, `DevelopmentSnapshot`): attributes {id, version_number, creation_date, te

- BL (Blockers, `Blocker`): attributes {id, title, description, severity, status, detected_on, resolved_on}.

- SH (Stakeholders, `Stakeholder`): attributes {id, name, organization, role, email, area_of_interest, influence

- VEL (Velocity, `Velocity`): attributes {id, number_of_sprints_used, avg._story_points, max_velocity, min_ve

- REP (Release Plans, `ReleasePlan`): attributes {id, version, planned_date, included_features, status}.

- RM (Roadmaps, `Roadmap`): attributes {id, start_date, end_date, milestones, objectives, versions}.

- SCB (Scrum Boards, `ScrumBoard`): attributes {id, board_type, columns_(todo/done...), number_of_cards,

- FED (Feature Docs, `FeatureDocumentation`): attributes {id, title, description, creation_date, change_log,

2   2. Indices

- $p \in P,\ t \in T,\ w \in W,\ f \in F,\ s \in S,\ r \in R,\ po \in PO,\ sm \in SM,$

- $pb \in PB,\ sp \in SP,\ spp \in SPP,\ ds \in DS,\ sr \in SR,\ sre \in SRE,$

- $sbl \in SBL,\ sg \in SG,\ e \in E,\ us \in US,\ k \in TSK,\ dev \in DEV,$

- $bl \in BL,\ sh \in SH,\ vel \in VEL,\ rep \in REP,\ rm \in RM,\ scb \in SCB,\ fed \in FED.$

Relational reference (from Relationships R1–R22):

- R1: Teams $\rightarrow$ Projects; R2: Workers ("Employees") $\rightarrow$ Teams; R3: Workers $\rightarrow$ Skills; R4: Workers $\rightarrow$ Roles;

- R5: ProductOwner $\leftrightarrow$ ProductBacklog; R6: Teams $\leftrightarrow$ ScrumMaster;

- R7: ProductBacklog $\rightarrow$ Feature; R8: ProductBacklog $\rightarrow$ Epic; R9: Epic $\rightarrow$ UserStory;

- R10: UserStory $\rightarrow$ Task; R11: UserStory $\leftrightarrow$ SprintBacklog; R12: SprintBacklog $\rightarrow$ Sprint;

- R13: Sprint $\rightarrow$ SprintGoal; R14: ScrumBoard $\rightarrow$ Task; R15: FeatureDocumentation $\rightarrow$ Feature;

- R16: Task $\leftrightarrow$ Blocker; R17: Stakeholder $\leftrightarrow$ SprintReview;

- R18: ScrumMaster $\rightarrow$ SprintRetrospective; R19: Velocity $\rightarrow$ Team;

- R20: ReleasePlan $\rightarrow$ Feature; R21: ReleasePlan $\rightarrow$ Roadmap; R22: Sprint $\rightarrow$ DevelopmentSnapshot.

3   3. Goals

Let the following parameters be read from entity attributes: budget_p, priority_f, priority_e^E, sp_{us}, effort_k, achGoal_{sp}, totEff_{sbl}, sev_{bl}, $\overline{SP}_{vel}$, trend_{vel}, infl_{sh}, durDS_{ds}, durSPP_{spp}, sat_{sre}. Decision variables are given in Sec. 5.

ze_project_budget $\min \sum\limits_{t \in T} \sum\limits_{p \in P} \text{budget}_p \cdot x_{t,p}^{TP}.$

priority_delivered $\max \sum\limits_{f \in F} \sum\limits_{rep \in REP} \text{priority}_f \cdot x_{f,rep}^{FR}.$

tory_story_points $\max \sum\limits_{us \in US} \sum\limits_{sbl \in SBL} \text{sp}_{us} \cdot x_{us,sbl}^{US,SB}.$

nimize_task_effort $\min \sum\limits_{k \in TSK} \sum\limits_{us \in US} \text{effort}_k \cdot x_{k,us}^{K,US}.$

goal_achievement $\max \sum\limits_{sp \in SP} \text{achGoal}_{sp}.$

cklog_total_effort $\min \sum\limits_{sbl \in SBL} \sum\limits_{sp \in SP} \text{totEff}_{sbl} \cdot x_{sbl,sp}^{SB,SP}.$

e_blocker_severity $\min \sum\limits_{k \in TSK} \sum\limits_{bl \in BL} \text{sev}_{bl} \cdot x_{k,bl}^{K,BL}.$

$$\text{\_avg\_story\_points} \quad \max \sum_{vel \in VEL} \sum_{t \in T} \overline{SP}_{vel} \cdot x_{vel,t}^{VEL,T}.$$

$$\text{ize\_velocity\_trend} \quad \max \sum_{vel \in VEL} \sum_{t \in T} \text{trend}_{vel} \cdot x_{vel,t}^{VEL,T}.$$

$$\text{fluence\_addressed} \quad \max \sum_{sh \in SH} \sum_{sr \in SR} \text{infl}_{sh} \cdot x_{sh,sr}^{SH,SR}.$$

$$\text{y\_scrum\_duration} \quad \min \sum_{ds \in DS} \text{durDS}_{ds}.$$

$$\text{planning\_duration} \quad \min \sum_{spp \in SPP} \text{durSPP}_{spp}.$$

$$\text{team\_satisfaction} \quad \max \sum_{sre \in SRE} \text{sat}_{sre}.$$

(Optional scalarization) Using weights w_i from Goals.csv, one can form a single objective:

$$\max \sum_{i \in \{\text{max-goals}\}} w_i \cdot g_i \; - \sum_{j \in \{\text{min-goals}\}} w_j \cdot g_j.$$

4 4. Conditions

Let $C_{sp}^{\max}$ denote exogenous capacity (story points) for sprint sp (e.g., derived from velocity), $S^{\max}$ a blocker severity cap per sprint, WIP_{scb} the board WIP limit. The following constraints correspond to Conditions.csv and encode key relationships (R1,R6,R9–R12,R16,R17,R20,R22) and operational bounds.

$$\text{ne\_sprint\_backlog} \quad \sum_{sbl \in SBL} x_{us,sbl}^{US,SB} \leq 1, \ \forall us \in US.$$

$$\text{ngs\_to\_one\_sprint} \quad \sum_{sp \in SP} x_{sbl,sp}^{SB,SP} = 1, \ \forall sbl \in SBL.$$

$$\text{actly\_one\_project} \quad \sum_{p \in P} x_{t,p}^{TP} = 1, \ \forall t \in T.$$

$$\text{ne\_scrum\_master} \quad \sum_{sm \in SM} x_{t,sm}^{T,SM} = 1, \ \forall t \in T.$$

$$\text{to\_one\_user\_story} \quad \sum_{us \in US} x_{k,us}^{K,US} = 1, \ \forall k \in TSK.$$

$$\text{longs\_to\_one\_epic} \quad \sum_{e \in E} x_{us,e}^{US,E} = 1, \ \forall us \in US.$$

$$\text{everity\_threshold} \quad \sum_{bl \in BL} \text{sev}_{bl} \cdot x_{k,bl}^{K,BL} \leq S^{\max}, \ \forall k \in TSK.$$

$$\text{it\_on\_scrumboard} \quad \sum_{k \in TSK} \nVdash[k \text{ on } scb] \leq \text{WIP}_{scb} = \text{number\_of\_cards}_{scb}, \ \forall scb \in SCB.$$

$$\text{n\_sprint\_capacity} \quad \sum_{us \in US} \sum_{sbl \in SBL} \text{sp}_{us} \, x_{us,sbl}^{US,SB} \, x_{sbl,sp}^{SB,SP} \leq C_{sp}^{\max}, \ \forall sp \in SP.$$

um_duration_limit $\mathrm{durDS}_{ds} \leq 15, \ \forall ds \in DS.$

ng_duration_limit $\mathrm{durSPP}_{spp} \leq 240, \ \forall spp \in SPP.$

ew_min_attendees $\displaystyle\sum_{sh \in SH} x_{sh,sr}^{SH,SR} \geq A^{\min}, \ \forall sr \in SR.$

5 5. DecisionVariables

- **D0 assign_user_story_to_sprint_backlog**: $x_{us,sbl}^{US,SB} \in \{0,1\}.$

- **D1 assign_task_to_user_story**: $x_{k,us}^{K,US} \in \{0,1\}.$

- **D2 include_feature_in_release_plan**: $x_{f,rep}^{FR} \in \{0,1\}.$

- **D3 assign_team_to_project**: $x_{t,p}^{TP} \in \{0,1\}.$

- **D4 assign_scrum_master_to_team**: $x_{t,sm}^{T,SM} \in \{0,1\}.$

- **D5 assign_user_story_to_epic**: $x_{us,e}^{US,E} \in \{0,1\}.$

- **D6 link_blocker_to_task**: $x_{k,bl}^{K,BL} \in \{0,1\}.$

- **D7 attach_sprint_backlog_to_sprint**: $x_{sbl,sp}^{SB,SP} \in \{0,1\}.$

- **D8 invite_stakeholder_to_sprint_review**: $x_{sh,sr}^{SH,SR} \in \{0,1\}.$

- **D9 bind_velocity_to_team**: $x_{vel,t}^{VEL,T} \in \{0,1\}.$

- **D10 generate_snapshot_for_sprint**: $x_{sp,dev}^{SP,DEV} \in \{0,1\}.$

- **D11 assign_worker_to_team**: $x_{w,t}^{W,T} \in \{0,1\}.$

- **D12 assign_skill_to_worker**: $x_{w,s}^{W,S} \in \{0,1\}.$

- **D13 assign_role_to_worker**: $x_{w,r}^{W,R} \in \{0,1\}.$