

MODULE *WorkflowValidationPretty*
 EXTENDS *WorkflowValidation*

$\$T\$$... The set of all tasks T
 $T \triangleq TaskNames$ e.g. $\$T = \{“EVI”, “XRAY”, “IVI”\}$
 $\$t^*\$$... The predicate indicating the repeatability of a task t
 $t^* \triangleq Task(t).repeatable$ e.g. $\$“XRAY”^* = true\$$
 $\$destr(t)\$$... The predicate indicating the destructiveness of a task t
 $destr(t) \triangleq Task(t).group = “destructive”$ e.g. $\$destr(“IVI”) = true\$$
 $\$non_destr(t)\$$... The predicate indicating the non-destructiveness of a task t
 $non_destr(t) \triangleq Task(t).group = “non-destructive”$ e.g. $\$non_destr(“EVI”) = true\$$

 $\$A \prec B\$, \$B \succ A\$$... The partial order relation between tasks
 $A \prec B \triangleq ConRel[A, B]$ e.g. $\$“EVI” \prec “XRAY”\$$
 $B \succ A \triangleq ConRel[A, B]$ e.g. $\$“IVI” \succ “XRAY”\$$
 $\$A \preceq B\$, \$B \succeq A\$$... The reflexive transitive closure over the partial order relation
 $A \preceq B \triangleq TransConRel[A, B]$ e.g. $\$“EVI” \preceq “IVI”\$$
 $B \succeq A \triangleq TransConRel[A, B]$ e.g. $\$“IVI” \succeq “EVI”\$$
 $\$A \vdash B\$, \$B \dashv A\$$... The relation describing whether one task requires another task
 $A \vdash B \triangleq RequiresRel[A, B]$ e.g. $\$“XRAY” \vdash “EVI”\$$
 $B \dashv A \triangleq RequiresRel[A, B]$ e.g. $\$“XRAY” \dashv “IVI”\$$

 $\$W\$$... the sequence of workflow tasks W
 $W \triangleq Workflow$ e.g. $\$W = \langle “EVI”, “IVI”, “EVI” \rangle\$$
 $\$T(W)\$$... The set of all workflow tasks $T(W)$
 $T(W) \triangleq RAN(W)$ e.g. $\$T(W) = \set{“EVI”, “IVI”}\$$
 $\$W \setminus \neq t\$$... The amount of occurrences of task t in the given workflow sequence
 $W \#\# t \triangleq Count(W, t)$ e.g. $\$W \setminus \neq \set{“EVI”} = 2\$$
 $\$W @@ t\$$... The set of all indexes of a task t in the given workflow sequence
 $W @@ t \triangleq Indexes(W, t)$ e.g. $\$W @@ “EVI” = \set{1, 3}\$$
 $\$W \setminus string^t\$$... The first index of a task t in the given workflow sequence
 $W^t \triangleq FirstIndex(W, t)$ e.g. $\$W \setminus string^t \set{“IVI”} = 2\$$
 $\$W \setminus \$ \$ t\$$... The last index of a task t in the given workflow sequence
 $W \$ \$ t \triangleq LastIndex(W, t)$ e.g. $\$W \setminus \$ \$ “EVI” = 3\$$

All tasks must be known

$KnownTaskConstraint \triangleq$
 $\forall t_w \in T(W) : \exists t \in T : t_w = t$

Non-repeatable tasks must not be repeated

$RepeatabilityConstraint \triangleq$
 $\forall t \in T : t \in T(W) \wedge \neg t^* \Rightarrow W \#\# t \leq 1$

Destructive tasks must come after non-destructive ones

DestructiveOrderConstraint \triangleq

$$\forall d, n \in T : \\ d \neq n \wedge d \in T(W) \wedge n \in T(W) \wedge destr(d) \wedge non_destr(n) \Rightarrow W^{\wedge}d > W^{\wedge}n$$

Task order must adhere to (transitive) partial order

PartialOrderConstraint \triangleq

$$\forall a, b \in T : \\ a \neq b \wedge a \preceq b \wedge a \in T(W) \wedge b \in T(W) \wedge (\neg a^* \vee \neg b^*) \Rightarrow W^{\wedge}a < W^{\wedge}b$$

Required tasks must be done before / after dependent tasks

MandatoryDependencyConstraint \triangleq

$$\forall a, b \in T : \\ \wedge a \neq b \wedge a \preceq b \wedge a \vdash b \wedge a \in T(W) \Rightarrow b \in T(W) \wedge W^{\wedge}a < W^{\wedge}b \\ \wedge a \neq b \wedge a \preceq b \wedge a \dashv b \wedge b \in T(W) \Rightarrow a \in T(W) \wedge W^{\wedge}a < W^{\wedge}b$$

Required tasks must be done in between dependent tasks, in case of repetition

MandatoryRepetitionConstraint \triangleq

$$\forall a, b \in T : \\ \wedge \\ \wedge a \neq b \wedge a \preceq b \wedge a \vdash b \wedge a \in T(W) \wedge b \in T(W) \\ \Rightarrow \forall i, j \in (W @@ a) : i < j \Rightarrow \exists k \in (W @@ b) : i < k \wedge k < j \\ \wedge \\ \wedge a \neq b \wedge a \preceq b \wedge a \dashv b \wedge a \in T(W) \wedge b \in T(W) \\ \Rightarrow \forall i, j \in (W @@ b) : i < j \Rightarrow \exists k \in (W @@ a) : i < k \wedge k < j$$