$[PERSON]$

$[TOPIC]$

ProjectAlloc

$$
\begin{array}{l}
studInterests, lecInterests : PERSON \pfun \mathrm{iseq}\ TOPIC \\
allocation : PERSON \pfun PERSON \\
maxPlaces : PERSON \pfun \mathbb{N} \\
\hline
\mathrm{dom}\ studInterests \cap \mathrm{dom}\ lecInterests = \{\} \\
\mathrm{dom}\ allocation \subseteq \mathrm{dom}\ studInterests \\
\mathrm{ran}\ allocation \subseteq \mathrm{dom}\ lecInterests \\
\mathrm{dom}\ maxPlaces = \mathrm{dom}\ lecInterests \\
\forall\, lec : \mathrm{dom}\ maxPlaces \\
\bullet\ \#(allocation \rhd \{lec\}) \leq maxPlaces\ lec
\end{array}
$$

InitProjectAlloc

$$
\begin{array}{l}
ProjectAlloc \\
\hline
lecInterests' = \{\} \\
studInterests' = \{\}
\end{array}
$$

AddStudent

$$
\begin{array}{l}
\Delta ProjectAlloc \\
s? : PERSON \\
ts? : \mathrm{iseq}\ TOPIC \\
\hline
s? \notin \mathrm{dom}\ studInterests \cup \mathrm{dom}\ lecInterests \\
studInterests' = studInterests \cup \{s? \mapsto ts?\} \\
lecInterests' = lecInterests \\
allocation' = allocation \\
maxPlaces' = maxPlaces
\end{array}
$$

AddLecturer

$$
\begin{array}{l}
\Delta ProjectAlloc \\
l? : PERSON \\
ts? : \mathrm{iseq}\ TOPIC \\
maxAlloc? : \mathbb{N}_1 \\
\hline
l? \notin \mathrm{dom}\ studInterests \cup \mathrm{dom}\ lecInterests \\
lecInterests' = lecInterests \cup \{l? \mapsto ts?\} \\
maxPlaces' = maxPlaces \cup \{l? \mapsto maxAlloc?\} \\
studInterests' = studInterests \\
allocation' = allocation
\end{array}
$$

Allocate

$\Delta ProjectAlloc$
$s? : PERSON$

$s? \in \operatorname{dom} studInterests$
$s? \notin \operatorname{dom} allocation$
$\exists\, sup : \operatorname{dom} lecInterests;\ t : TOPIC;\ i, j : \mathbb{N}$
$\mid maxPlaces\ sup > \#(allocation \rhd \{sup\})$
$\land\ i \mapsto t \in studInterests\ s?$
$\land\ j \mapsto t \in lecInterests\ sup$
$\bullet\ ($
$\forall\, lec : \operatorname{dom} lecInterests;\ k : \mathbb{N} \mid maxPlaces\ lec > \#(allocation \rhd \{lec\})$
$\bullet\ ($
$(k \mapsto t \in lecInterests\ lec \Rightarrow k \geq j)$
$\land$
$(\operatorname{ran}(1 \mathinner{..} i - 1 \lhd studInterests\ s?)$
$\cap \operatorname{ran}(lecInterests\ lec) = \{\})$
$\land$
$allocation' = allocation \cup \{s? \mapsto sup\}$
$)$
$studInterests' = studInterests$
$lecInterests' = lecInterests$

DeAllocate

$\Delta ProjectAlloc$
$s? : PERSON$

$\exists\, sup : \operatorname{dom} lecInterests$
$\bullet\ (s? \mapsto sup \in allocation$
$\land\ allocation' = allocation \setminus \{s? \mapsto sup\})$
$studInterests' = studInterests$
$lecInterests' = lecInterests$

RemoveLecsTopic

$\Delta ProjectAlloc$
$l? : PERSON$
$t? : TOPIC$

$l? \in \operatorname{dom} lecInterests$
$t? \in \operatorname{ran}(lecInterests\ l?)$
$lecInterests' =$
$lecInterests \oplus$
$\{l? \mapsto squash\,(lecInterests\ l? \rhd \{t?\})\}$
$studInterests' = studInterests$
$allocation' = allocation$

LecsAvailable

$\Xi ProjectAlloc$
$t? : TOPIC$
$ps! : \mathbb{P}\, PERSON$

$ps! =$
$\{p : \mathrm{dom}\, lecInterests \mid t? \in \mathrm{ran}(lecInterests\, p)$
$\land\ maxPlaces\, p > \#(allocation \rhd \{p\})\}$

$MESSAGE ::= success \mid isStudent \mid isLecturer \mid notStudent \mid isAllocated \mid noLecAvailable \mid notAllocated \mid$

O2

$SuccessMessage \mathrel{\widehat=} [outcome! : MESSAGE \mid outcome! = success$

IsStudent

$\Xi ProjectAlloc$
$s? : PERSON$
$outcome! : MESSAGE$

$s? \in \mathrm{dom}\, studInterests$
$outcome! = isStudent$

IsLecturer

$\Xi ProjectAlloc$
$s? : PERSON$
$outcome! : MESSAGE$

$s? \in \mathrm{dom}\, lecInterests$
$outcome! = isLecturer$

NotStudent

$\Xi ProjectAlloc$
$s? : PERSON$
$outcome! : MESSAGE$

$s? \notin \mathrm{dom}\, studInterests$
$outcome! = notStudent$

IsAllocated

$\Xi ProjectAlloc$
$s? : PERSON$
$outcome! : MESSAGE$

$s? \notin \mathrm{dom}\, allocation$
$outcome! = isAllocated$

NoLecsAvailable

$\Xi ProjectAlloc$
$s? : PERSON$
$outcome! : MESSAGE$

$\neg(\exists\, sup : \mathrm{dom}\, lecInterests \bullet$
$maxPlaces\ sup > \#(allocation \rhd \{sup\})$
$\land$
$\mathrm{ran}(studInterests\ s?) \cap \mathrm{ran}(lecInterests\ sup) \neq \{\})$
$outcome! = noLecAvailable$

NotAllocated

$\Xi ProjectAlloc$
$s? : PERSON$
$outcome! : MESSAGE$

$s? \notin \mathrm{dom}\, allocation$
$outcome! = notAllocated$

NoLecturer

$\Xi ProjectAlloc$
$l? : PERSON$
$outcome! : MESSAGE$

$l? \notin \mathrm{dom}\, lecInterests$
$outcome! = notLecturer$

NotListedTopic

$\Xi ProjectAlloc$
$l? : PERSON$
$t? : TOPIC$
$outcome! : MESSAGE$

$t? \notin \mathrm{ran}(lecInterests\ l?)$
$outcome! = notListedTopic$

SupsDiffer

$\Delta ProjectAlloc$
$s? : PERSON$

$\exists\, old, new : \mathrm{dom}\, lecInterests$
$\bullet\ (s? \mapsto old \in allocation \land$
$s? \mapsto new \in allocation' \land$
$old \neq new)$