

FMSE Exercise Course 1: Solutions

1.

$[NAME, DATE]$

<i>BirthdayBook</i> $names : \mathbb{P} NAME$ $birthday : NAME \leftrightarrow DATE$ <hr/> $\text{dom } birthday \subseteq names$
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2.

$[USER, PWORD]$

<i>LogSys</i> $registered : \mathbb{P} USER$ $logged_on : \mathbb{P} USER$ $password : USER \leftrightarrow PWORD$ <hr/> $logged_on \subseteq \text{dom } password$ $\text{dom } password \subseteq registered$
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The last line could also be $\text{dom } password = registered$, depending on a design choice.

3. A variant of the schema in the lecture slides:

$[BOOK, READER, CATEGORY]$

| $limit : CATEGORY \rightarrow \mathbb{N}$

<i>Library</i> \dots $categ : READER \leftrightarrow CATEGORY$ <hr/> \dots $\forall r : \text{ran } issued \bullet$ $\quad \#\{b : BOOK \mid issued(b) = r\} \leq limit(categ(r))$ $\text{ran } issued \subseteq \text{dom } categ$

4. The value of *videos* is just one video, though the name suggests a set of videos.

5. $\{\emptyset, \{a\}, \{b\}, \{a, b\}\}$
6. The last predicate is superfluous and can be removed.
7. The predicate is superfluous.
- 8.

[TEACHER, SUBJECT, Timester]

<i>Schedule</i>
$teachers : \mathbb{P} TEACHER$ $subjects : \mathbb{P} SUBJECT$ $teaches : TEACHER \rightarrow \mathbb{P} SUBJECT$ $trim : SUBJECT \rightarrow TRIMESTER$
$dom\ teaches \subseteq teachers$ $ran\ teaches \subseteq \mathbb{P} subjects$ $dom\ trim \subseteq subjects$

- 9.

[PERSON]

<i>Anchor</i>
$barmaids : \mathbb{P} PERSON$ $sailors : \mathbb{P} PERSON$ $loves : PERSON \rightarrow \mathbb{P} PERSON$
$dom\ loves \subseteq sailors$ $ran\ loves \subseteq \mathbb{P}(sailors \cup barmaids)$ $\dots a, b, or\ c \dots$

- a $\forall s : sailors \bullet \exists b : barmaids \bullet b \in loves(s)$
- b $\forall s : sailors \bullet \#(loves(s) \cap barmaids) = 1$
- c $\exists b : barmaids \bullet \forall s : sailors \bullet b \in loves(s)$

- 10.

<i>Date</i>
$day : 1..31$ $month : MONTH$
$month \in \{apr, jun, sep, nov\} \Rightarrow day \leq 30$ $month = feb \Rightarrow day \leq 28$