Tutorial 6

1) Let [COUNTRY] be the set of all countries in the world, and [DATE] be the set of all dates of a given year.

Given below a state space schema called *Holiday* to represent public holidays in different countries in each year,

Holiday

$publicHoliday : COUNTRY \leftrightarrow DATE$

COUNTRY	DATE
Malaysia	1/1/2024
Singapore	1/1/2024
Malaysia	25/12/2024
Thailand	1/1/2024
Singapore	25/12/2024
…	…
publicHoliday	

(a) Write an initial state called *InitHoliday* where the *Holiday* is empty.

InitHoliday

Holiday

$publicHoliday = \varnothing$

(b) Write an operation schema called *AddHoliday* that will add a new public holiday date *d?* for a country *c?*.

AddHoliday

$\Delta\ Holiday$
$c? : COUNTRY$
$d? : DATE$

$c? \mapsto d? \notin publicHoliday$
$publicHoliday' = publicHoliday \cup \{c? \mapsto d?\}$

(c) Write an operation schema called *AbolishHoliday* that will abolish a date *d?* from public holidays in a country *c?*.

AbolishHoliday

$\Delta\ Holiday$
$c? : COUNTRY$
$d? : DATE$

$c? \mapsto d? \in publicHoliday$
$publicHoliday' = publicHoliday \setminus \{c? \mapsto d?\}$

(d) Write a query schema called *TotalHoliday* that will display the total number of public holidays *total!* in a country *c?*.

TotalHoliday

$\Xi\ Holiday$
$c? : COUNTRY$
$total! : \mathbb{N}$

$c? \in \text{dom}\ publicHoliday$
$total! = \#(\{c?\} \lhd publicHoliday)$ >>> domain restriction
OR
$total! = \#(publicHoliday\ (\!|\{c?\}|\!))$ >>> relational image
$publicHoliday' = publicHoliday$

(e) Write a query schema called *HolidayDates* that will find all the dates of public holidays *ds!* in a country *c?*.

HolidayDates

Ξ *Holiday*
c? : *COUNTRY*
ds! : $\mathbb{P}$ *DATE*

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c? $\in$ *dom publicHoliday*
total! = ran({*c*?} $\lhd$ *publicHoliday*) >>> domain restriction
OR
total! = ran(*publicHoliday* $(\!|$ {c?} $|\!)$) >>> relational image
publicHoliday' = *publicHoliday*

2) Consider a specification for a phone directory which relates people to their phone numbers.

We introduce two basic types:
[PERSON] - the set of all possible persons in the system
[PHONE] - the set of all possible phone numbers in the system

and a free type:
REPLY::= yes | no

Given to you the state space schema called *Directory*

Directory
dir : *PERSON* $\leftrightarrow$ *PHONE*

(a)

(a) Write an operation state schema called *AddEntry* to add *name?* and *number?* to the directory.

(b) Write an operation state schema called *RemoveEntry* that remove an entry from the directory.

(c) Write an operation state schema called *GetNumbers* that will show all the phone numbers associated with a name.

(d) Write an operation state schema called *GetNames* that will show all the names associated with a phone number.

(e) Write an operation state schema called *BelongsTo* that will produce a reply *rep!* whether a given phone number *number?* is a phone number for a person *name?* or not.