

Coursework: Extending the formal model for a Library System

This exercise explores an *extension* or further *refinement* of the requirements for a library system, introducing dates and periods into the model. To this end you should assume a pre-defined type **DATE** is provided, along with the usual relations ($<$, \leq , $=$, \neq , \geq , $>$) for comparing such values, e.g. “ d_1 is before d_2 ” is denoted by $d_1 < d_2$. Assume also that two operators $+$ and $-$ are defined, which may be used to express a **DATE** some non-zero number of days *later* (respectively *earlier*) than their first argument. Thus $d + 3$ denotes the date 3 days after d , $d - 1$ denotes the date 1 day before d , etc.

1. Introduce the notion of permissible periods for any loan – e.g. an overnight loan, a standard loan, a long-term loan, and so on, where durations are measured in a whole number of *days*.
2. To incorporate such a concept into the given model for this system, you will need to consider at least some aspects of the daily operating cycle, e.g. adding the notion of *today's* date, and some way of moving on to the *next* day.
3. Impose a constraint on reservations – such that they never last for more than n (e.g. 7) days: in other words, they all expire if not cancelled or transformed into a loan within that period.

Your report should be presented in the following forms:

- i. An *informal* description of the extension, written in English. You should justify any choices you have made.
- ii. An extension of the *formal* model.

You are expected to extend the highest-level invariant (class *LS*) to create a new class (say *LD*). It will be necessary to extend some of the existing operations (queries and events) and to provide new ones in order to satisfy the additional requirements. You should consider the appropriate level of abstraction for the model. As such, try to be *clear*, *simple*, *precise*, and *general*; there will inevitably be some *tension* amongst these competing objectives.