

## Characterizing temporal repetition<sup>o</sup>

Diana Cukierman and James Delgrande

School of Computing Science  
Simon Fraser University  
Burnaby, BC, Canada V5A 1S6  
{diana,jim}@cs.sfu.ca

We are investigating the representation and reasoning about schedulable, repeated activities, specified using calendars. Examples of such activities include meeting every Tuesday and Thursday during a semester and attending a seminar every first day of a month. This research provides for a valuable framework for scheduling systems, financial systems and, in general, date-based systems. Very recently work has been done related to reasoning about repetition in the Artificial Intelligence community and others. A partial reference list is provided here (Cukierman & Delgrande 1995; Leban, McDonald, & Forster 1986). However, to our knowledge no extensive taxonomy of repetition has been proposed in the literature. We believe that reasoning about repeated activities calls for a study and precise definition of the topological characteristics in a repetitive series. In this abstract we summarize a proposal to classify types of repetition according to parameters. The combination of all possible values of these parameters provides a complete taxonomy of repetitive classes with respect to the proposed parameters. Several notions of repetition are considered, some are extremely general, some are very specific.

Time intervals and time points during which a repeated event, activity or property of interest occur are referred to as *temporal objects*. *Gaps* are also conceived as temporal objects, representing the separation between successive repeats in a *series*. A *temporal series*  $\mathcal{T}$  of  $n \in \mathbb{N}$  repeats is a sequence of  $2n$  elements:  $\mathcal{T} = \langle r_1, g_1, r_2, g_2, \dots, r_n, g_n \rangle$ , where  $r_i$  and  $g_i$  are temporal objects, the  $i^{\text{th}}$  repeat and the  $i^{\text{th}}$  gap respectively;  $i \in \mathbb{N}, 1 \leq i \leq n$ . The *interval of reference* is the interval that starts when the first repeat starts and finishes when the  $n^{\text{th}}$  gap finishes. Durations are expressed with *time units*. See (Cukierman & Delgrande 1995) for a formal definition of time units, examples of time units include *year*, *week*, etc. An *interval series* is a temporal series whose repeats are intervals. The beginning point of a subsequent repeat can be equal or after the beginning point of the previous one. Therefore two contiguous intervals relate with the re-

lations in the set {before, meets, overlaps, finished-by, contains, starts, started-by, equals} or a disjunction of the previous. These relations are part of the basic 13 interval relations (Allen 1983). Series are organized in a taxonomy according to possible combinations of “values” each parameter or classification axis takes. We distinguish five parameters: *Interval series qualitative structure*, *Duration of repeats pattern*, *Distance between repeats pattern*, *Frequency of repeats per period of time*, and additionally, we distinguish repetitions which stem from the *application domain* and not the temporal domain and we analyze how the *reference frame* can be specified. For example, the *duration of repeats pattern* can be *constant durations* as in “series of experiments of 10 min each”. Another possible value is *(time unit) based constant durations*, where the constancy is apparent because of the time unit. Other values that we consider are *bounded durations*, *probabilistic durations*, *cyclical equal durations*, *cyclical functionally related durations*, *known a-priori durations* and *unspecified repetition pattern of durations*.

The combination of all the possible values of the parameters defined generates a taxonomy of repetitive series. Arguably not all the values generate a realistic repetition pattern, and several combinations may result in the same class. The analysis of all possible combinations of the parameter values is under study. We believe this characterization already provides for a simple and complete classification or scheme of classification of repetitive series.

### References

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<sup>o</sup>This is an extended abstract of our paper in the TIME'96 workshop.