# Point and Interval Algebra

1. //if i precedes j then either i and j are both ‘temporal instant’, or both are ‘temporal interval’, or both are ‘process’, or both are ‘process boundary’, or i is ‘temporal interval’ and j is ‘temporal instant’, or i is ‘temporal instant’ and j is ‘temporal interval’.
   1. // If i and j are both ‘temporal instants’ such that the measured value of i is less than the measured value of j, then i precedes j.
   2. //If i and j are both ‘temporal interval’ such that i either ‘before’ j or ‘meets’ j, then i precedes j.
   3. //If i and j are both ‘temporal interval’ such that the temporal extent of i precedes the temporal extent of j, then i precedes j.
   4. //If i and j are both ‘process boundary’ and the ‘temporal instant’ that i occupies precedes ‘temporal instant’ that j occupies, then i precedes j.
   5. // if i is ‘temporal instant’ and j is ‘temporal interval’ and i precedes the first instance of j then i precedes j.
   6. // if i is ‘temporal interval’ and j is ‘temporal instance’ and the last instance of i precedes j then i precedes j.

//’before’ holds between two temporal regions or two processes.

* 1. //before is irreflexive
  2. //before is antisymmetric
  3. //before is transitive
  4. //time regresses infinitely in the past (sparse time).
  5. //time advances infinitely in the future (sparse time).

Note: 1.4 and 1.5 together axiomatizes infinite flow of time.



//if both i and j are ‘Temporal Interval’ and the last ‘Temporal Instant’ of i is ‘precedes’ the first ‘Temporal Instant’ of j then i is precedes j.

//if both i and j are ‘process’ and the ‘Temporal Region’ occupied by i is ‘before’ the ‘Temporal Region’ occupied by j then i is before j.

* 1. //after is inverse of before
  2. //’equals’ is reflexive
  3. //’equals’ is symmetric
  4. //’equals’ is transitive

//if both i and j are ‘Temporal Instant’ such that the measured value of i is equal than the measured value of j then i equals j.

//if both i and j are ‘Temporal Interval’, the first ‘Temporal Instant’ of i ‘equals’ the last ‘Temporal Instant’ of j, and the last ‘Temporal Instant’ of i ‘equals’ the last ‘Temporal Instant’ of j then i is before j.

//if both i and j are ‘process’ and the ‘Temporal Region’ occupied by i is ‘equals’ the ‘Temporal Region’ occupied by j then i is before j.

1. //before composed with after
2. //after composed with before
3. //before composed with equals
4. //equals composed with before
5. //after composed with equals
6. //equals composed with after
7. //if i meets, overlaps, starts, during, or ends j then both i and j are either ‘Temporal Interval’ or ‘process’.
   1. //meets is inverse of metBy
   2. //overlaps is inverse of overlappedBy
   3. //starts is inverse of startedBy
   4. //during is inverse of contains
8. //if i meets j then i is before j and there does not exist any ‘Temporal Interval’ or ‘process’ k such that i is before k and k is before j.
   1. //’meets’ is irreflexive
   2. //’meets’ is asymmetric
   3. //’meets’ is non-transitive
   4. //meeting places are linearly ordered – 1

meets(i,j) ------X---------- ------X---------- ------X----------

meets(k,l) ---------X-------- ---------X-------- ---------X--------

* 1. //meeting places are linearly ordered – 2
  2. //meeting places are linearly ordered – 3
  3. //meeting places are unique

i -------

j -------

k --------------

l ----

m ----



//if both i and j are ‘Temporal Interval’ and the last ‘Temporal Instant’ of i ‘equals’ the first ‘Temporal Instant’ of j then i meets j.

//if both i and j are ‘process’ and the ‘Temporal Region’ occupied by i is ‘before’ the ‘Temporal Region’ occupied by j then i is before j.

* 1. //time regresses infinitely in the past. (dense time)
  2. //time advances infinitely in the future. (dense time)

1. //if i starts j then there exists a ‘Temporal Interval’ k such that k meets both i and j and there exists a ‘Temporal Interval’ l such that i is before l and j meets l.
   1. //if i and j are both ‘Temporal Interval’ and i starts j then the first ‘Temporal Instant’ of i ‘equals’ the first ‘Temporal Instant’ of j and the last ‘Temporal Instant’ of i is before the last ‘Temporal Instant’ of j.
   2. //if i and j are both ‘processes’ and i starts j then the ‘Temporal Interval’ that i occupies starts the ‘Temporal Interval’ that j occupies.
2. //if i ends j then there exists a ‘Temporal Interval’ k such that i meets k and j meets k and there exists a ‘Temporal Interval’ l such that l is before i and meets j.
   1. //if i and j are both ‘Temporal Interval’ and i ends j then the first ‘Temporal Instant’ of j is ‘before’ the first ‘Temporal Instant’ of i and the last ‘Temporal Instant’ of i ‘equals’ the last ‘Temporal Instant’ of j.
   2. //if i and j are both ‘processes’ and i ends j then the ‘Temporal Interval’ that i occupies ends the ‘Temporal Interval’ that j occupies.
3. //if I start j then there exists a ‘Temporal Interval’ k that ends i and starts k.
   1. //if i and j are both ‘Temporal Interval’ and i overlaps j then the first ‘Temporal Instant’ of j is ‘before’ the last ‘Temporal Instant’ of I, the first ‘Temporal Instant’ of i is ‘before’ the first ‘Temporal Instant’ of j, and the last ‘Temporal Instant’ of i is ‘before’ the last ‘Temporal Instant’ of j.
   2. //if i and j are both ‘processes’ and i overlaps j then the ‘Temporal Interval’ that i occupies ‘overlaps’ the ‘Temporal Interval’ that j occupies.
4. //if I start j then there exists a ‘Temporal Interval’ k that ends i and starts k.
   1. //if i and j are both ‘Temporal Interval’ and i overlaps j then the first ‘Temporal Instant’ of j ‘precedes’ the first ‘Temporal Instant’ of i, and the last ‘Temporal Instant’ of i ‘precedes’ the last ‘Temporal Instant’ of j.
   2. //if i and j are both ‘processes’ and i is during j then the ‘Temporal Interval’ that i occupies is ‘during’ the ‘Temporal Interval’ that j occupies.