BFO 2020 Order Axioms

Precedes and preceded by are inverse relations [tib-1]

$\forall a,b\, (precedes(a,b) \leftrightarrow precededBy(b,a))$

Precedes is antisymmetric [hew-1]

$\forall a,b\, (precedes(a,b) \rightarrow \neg precedes(b,a))$

Precedes is transitive [ctz-1]

$\forall a,b,c\, (precedes(a,b) \land precedes(b,c) \rightarrow precedes(a,c))$

If the last instant of a temporal region precedes the first instant of another, then the first region precedes the second [qqv-1]

$\forall i1,i2,l1,f2\, (hasLastInstant(i1,l1) \land hasFirstInstant(i2,f2) \land precedes(l1,f2)$
$\rightarrow precedes(i1,i2))$

Precedes has domain occurrent and range occurrent [sen-1]

$\forall a,b\, (precedes(a,b) \rightarrow \exists t\, instanceOf(a,occurrent,t) \land \exists t\, instanceOf(b,occurrent,t))$

If you are part of something that precedes something else, you also precede it [wix-1]

$\forall o1,o2,o1p,o2p\, (occurrentPartOf(o1p,o1) \land occurrentPartOf(o2p,o2) \land precedes(o1,o2)$
$\rightarrow precedes(o1p,o2p))$

First instant of a temporal region that is not an instant precedes last instant [rzv-1]

$\forall t,ft,lt\, (\neg instanceOf(t,temporalInstant,t) \land hasFirstInstant(t,ft) \land hasLastInstant(t,lt)$
$\rightarrow precedes(ft,lt))$

If one temporal region precedes another then the first last time point precedes the second first time point [miz-1]

$\forall t1,t2,l1,f2\, (precedes(t1,t2) \land hasLastInstant(t1,l1) \land hasFirstInstant(t2,f2) \land l1 \neq f2$
$\rightarrow precedes(l1,f2))$

If one occurrent precedes another then they do not overlap temporally [aou-1]

$\forall p,q\, (precedes(p,q) \lor precedes(q,p)$
$\rightarrow \neg(\exists overlap\, (temporalPartOf(overlap,p) \land temporalPartOf(overlap,q))))$

Temporal instants are totally ordered [qnf-1]

$\forall t1,t2\, (instanceOf(t1,temporalInstant,t1) \land instanceOf(t2,temporalInstant,t2)$
$\rightarrow precedes(t1,t2) \lor precedes(t2,t1) \lor t1=t2)$

If the last instant of a temporal region is the first instant of another, the first region precedes the second [suk-1]

$\forall i1,i2,l1,f2\, (\neg instanceOf(i1,temporalInstant,i1) \land \neg instanceOf(i2,temporalInstant,i2)$
$\land hasLastInstant(i1,l1) \land hasFirstInstant(i2,f2) \land l1=f2$
$\rightarrow precedes(i1,i2))$

A last instant is either part of an extended region or is preceded by it [acg-1]

$\forall l,i\, (instanceOf(l,temporalInstant,l) \land instanceOf(i,temporalRegion,i)$
$\land \neg instanceOf(i,temporalInstant,i) \land hasLastInstant(i,l)$
$\rightarrow (\neg temporalPartOf(l,i) \leftrightarrow precedes(i,l)))$

A first instant is either part of an extended region or precedes it [qga-1]

$\forall f,i\, (instanceOf(f,temporalInstant,f) \land instanceOf(i,temporalRegion,i)$
$\land \neg instanceOf(i,temporalInstant,i) \land hasFirstInstant(i,f)$
$\rightarrow (\neg temporalPartOf(f,i) \leftrightarrow precedes(f,i)))$

If two temporal intervals do not overlap then one of them precedes the other [owb-1]

$\forall t1,t2\, (instanceOf(t1,temporalInterval,t1) \land instanceOf(t2,temporalInterval,t2)$
$\land \neg(\exists part\, (temporalPartOf(part,t1) \land temporalPartOf(part,t2)))$
$\rightarrow precedes(t1,t2) \lor precedes(t2,t1))$

If you temporally occupy part of something that precedes something else, you also precede it [wff-1]

$\forall o1,o2\, (\exists t1,t2\, ((occupiesTemporalRegion(o1,t1) \lor temporallyProjectsOnto(o1,t1) \lor t1=o1)$
$\land (occupiesTemporalRegion(o2,t2) \lor temporallyProjectsOnto(o2,t2) \lor t2=o2)$
$\land precedes(t1,t2))$
$\leftrightarrow precedes(o1,o2))$

If two processes that occupy temporal intervals do not overlap, one of them precedes the other [duz-1]

$\forall$o1,o2,t1,t2 (occupiesTemporalRegion(o1,t1)$\land$occupiesTemporalRegion(o2,t2)
$\land$instanceOf(t1,temporalInterval,t1)$\land$instanceOf(t2,temporalInterval,t2)
$\land\neg(\exists$part(temporalPartOf(part,t1)$\land$temporalPartOf(part,t2)))
$\rightarrow$precedes(o1,o2)$\lor$precedes(o2,o1))

$\forall$o1,o2,t1,t2 (occupiesTemporalRegion(o1,t1)$\land$occupiesTemporalRegion(o2,t2)
$\land$instanceOf(t1,temporalInterval,t1)$\land$instanceOf(t2,temporalInterval,t2)

Alan Ruttenberg, September 26, 2022. The most recent version of this file will always be in the GitHub repository https://github.com/bfo-ontology/bfo-2020