

BFO 2020 Order Axioms

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

$$\forall a,b(\text{precedes}(a,b) \leftrightarrow \text{precededBy}(b,a))$$

Precedes is antisymmetric [hew-1]

$$\forall a,b(\text{precedes}(a,b) \rightarrow \neg \text{precedes}(b,a))$$

Precedes is transitive [ctz-1]

$$\forall a,b,c(\text{precedes}(a,b) \wedge \text{precedes}(b,c) \rightarrow \text{precedes}(a,c))$$

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

$$\forall i1,i2,l1,f2(\text{hasLastInstant}(i1,l1) \wedge \text{hasFirstInstant}(i2,f2) \wedge \text{precedes}(l1,f2) \rightarrow \text{precedes}(i1,i2))$$

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

$$\forall a,b(\text{precedes}(a,b) \rightarrow \exists t \text{instanceOf}(a,\text{occurrent},t) \wedge \exists t \text{instanceOf}(b,\text{occurrent},t))$$

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

$$\forall o1,o2,o1p,o2p(\text{occurrentPartOf}(o1p,o1) \wedge \text{occurrentPartOf}(o2p,o2) \wedge \text{precedes}(o1,o2) \rightarrow \text{precedes}(o1p,o2p))$$

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

$$\forall t,ft,lt(\neg \text{instanceOf}(t,\text{temporalInstant},t) \wedge \text{hasFirstInstant}(t,ft) \wedge \text{hasLastInstant}(t,lt) \rightarrow \text{precedes}(ft,lt))$$

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

$$\forall t1,t2,l1,f2(\text{precedes}(t1,t2) \wedge \text{hasLastInstant}(t1,l1) \wedge \text{hasFirstInstant}(t2,f2) \wedge l1 \neq f2 \rightarrow \text{precedes}(l1,f2))$$

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

$$\forall p,q(\text{precedes}(p,q) \vee \text{precedes}(q,p) \rightarrow \neg (\exists \text{overlap}(\text{temporalPartOf}(\text{overlap},p) \wedge \text{temporalPartOf}(\text{overlap},q))))$$

Temporal instants are totally ordered [qnf-1]

$$\forall t1,t2(\text{instanceOf}(t1,\text{temporalInstant},t1) \wedge \text{instanceOf}(t2,\text{temporalInstant},t2) \rightarrow \text{precedes}(t1,t2) \vee \text{precedes}(t2,t1) \vee t1=t2)$$

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

$$\forall i1,i2,l1,f2(\neg \text{instanceOf}(i1,\text{temporalInstant},i1) \wedge \neg \text{instanceOf}(i2,\text{temporalInstant},i2) \wedge \text{hasLastInstant}(i1,l1) \wedge \text{hasFirstInstant}(i2,f2) \wedge l1=f2 \rightarrow \text{precedes}(i1,i2))$$

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

$$\forall l,i(\text{instanceOf}(l,\text{temporalInstant},l) \wedge \text{instanceOf}(i,\text{temporalRegion},i) \wedge \neg \text{instanceOf}(i,\text{temporalInstant},i) \wedge \text{hasLastInstant}(i,l) \rightarrow (\neg \text{temporalPartOf}(l,i) \leftrightarrow \text{precedes}(i,l)))$$

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

$$\forall f,i(\text{instanceOf}(f,\text{temporalInstant},f) \wedge \text{instanceOf}(i,\text{temporalRegion},i) \wedge \neg \text{instanceOf}(i,\text{temporalInstant},i) \wedge \text{hasFirstInstant}(i,f) \rightarrow (\neg \text{temporalPartOf}(f,i) \leftrightarrow \text{precedes}(f,i)))$$

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

$$\forall t1,t2(\text{instanceOf}(t1,\text{temporalInterval},t1) \wedge \text{instanceOf}(t2,\text{temporalInterval},t2) \wedge \neg (\exists \text{part}(\text{temporalPartOf}(\text{part},t1) \wedge \text{temporalPartOf}(\text{part},t2))) \rightarrow \text{precedes}(t1,t2) \vee \text{precedes}(t2,t1))$$

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

$$\forall o1,o2(\exists t1,t2((\text{occupiesTemporalRegion}(o1,t1) \vee \text{temporallyProjectsOnto}(o1,t1) \vee t1=o1) \wedge (\text{occupiesTemporalRegion}(o2,t2) \vee \text{temporallyProjectsOnto}(o2,t2) \vee t2=o2) \wedge \text{precedes}(t1,t2)) \leftrightarrow \text{precedes}(o1,o2))$$

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

$$\begin{aligned} &\forall o1,o2,t1,t2 (occupiesTemporalRegion(o1,t1) \wedge occupiesTemporalRegion(o2,t2) \\ &\quad \wedge instanceOf(t1,temporalInterval,t1) \wedge instanceOf(t2,temporalInterval,t2) \\ &\quad \wedge \neg(\exists part(temporalPartOf(part,t1) \wedge temporalPartOf(part,t2))) \\ &\quad \rightarrow precedes(o1,o2) \vee precedes(o2,o1)) \end{aligned}$$
