Appendix B Partial ASP Encodings

Figures in this section include parts of all encodings mentioned in the manuscript. In all cases, only the code that encodes the Equals and Finishes relations is shown. The remaining relations are encoded in a similar manner. Complete versions of the encodings are available at https://github.com/gmparg/ICLP2018. Figures B 1, B 2, B 3 and B 4 contain TC-6 encodings according to COI7, CTSA, CTSA2 and GEN, respectively. Figures B 5, B 6, B 7 and B 8 contain TC-10 encodings according to COI7, CTSA, CTSA2 and GEN, respectively.

```
{s(X,Y); f(X,Y); alt(X,Y); i(X,Y); eq(X,Y); dis(X,Y)}=1 :- traj(X), traj(Y), X!=Y.
eq(X,X) :- traj(X).
eq(Z,X) :- eq(Y,X), eq(Z,Y).                f(X,Z) :- f(X,Y), eq(Z,Y).
alt(Z,X) :- eq(Y,X), alt(Z,Y).              f(X,Z) :- f(X,Y), alt(Z,Y).
s(X,Z) :- eq(Y,X), s(Y,Z).                  i(X,Z) | dis(Z,X) :- f(X,Y), s(Y,Z).
f(X,Z) :- eq(Y,X), f(Y,Z).                  eq(Z,X) | alt(Z,X) | f(X,Z) :- f(X,Y), f(Y,Z).
i(X,Z) :- eq(Y,X), i(Y,Z).                  s(X,Z) | i(X,Z) | dis(Z,X) :- f(X,Y), i(Y,Z).
dis(Z,X) :- eq(Y,X), dis(Z,Y).              s(X,Z) | i(X,Z) | dis(Z,X) :- f(X,Y), dis(Z,Y).
:- eq(Z,X), s(X,Z).                         :- f(X,Z), s(X,Z).
:- eq(Z,X), f(X,Z).                         :- f(X,Z), alt(Z,X).
:- eq(Z,X), alt(Z,X).                       :- f(X,Z), i(X,Z).
:- eq(Z,X), i(X,Z).                         :- f(X,Z), eq(Z,X).
:- eq(Z,X), dis(Z,X).                       :- f(X,Z), dis(Z,X).
```

Fig. B 1. Partial COI7 encoding for TC-6.

```
{s(X,Y); f(X,Y); alt(X,Y); i(X,Y); eq(X,Y); dis(X,Y)}=1 :- traj(X), traj(Y), X<Y.
eq(X,X) :- traj(X).
:- eq(X,Y), eq(Y,Z), not eq(X,Z).   :- f(X,Y), eq(Y,Z), not f(X,Z).
:- eq(X,Y), alt(Y,Z), not alt(X,Z). :- f(X,Y), alt(Y,Z), not f(X,Z).
:- eq(X,Y), s(Y,Z), not s(X,Z).     :- f(X,Y), s(Y,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), f(Y,Z), not f(X,Z).     :- f(X,Y), f(Y,Z), not eq(X,Z), not alt(X,Z), not f(X,Z).
:- eq(X,Y), i(Y,Z), not i(X,Z).     :- f(X,Y), i(Y,Z), not s(X,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), dis(Y,Z), not dis(X,Z). :- f(X,Y), dis(Y,Z), not s(X,Z), not i(X,Z), not dis(X,Z).
```

Fig. B 2. Partial CTSA encoding for TC-6.

```
{s(X,Y); f(X,Y); alt(X,Y); i(X,Y); eq(X,Y); dis(X,Y)}=1 :- traj(X), traj(Y), X<Y,
 #count{R : fact(R,X,Y)} = 0.
eq(X,X) :- traj(X).
:- eq(X,Y), eq(Y,Z), not eq(X,Z).   :- f(X,Y), eq(Y,Z), not f(X,Z).
:- eq(X,Y), alt(Y,Z), not alt(X,Z). :- f(X,Y), alt(Y,Z), not f(X,Z).
:- eq(X,Y), s(Y,Z), not s(X,Z).     :- f(X,Y), s(Y,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), f(Y,Z), not f(X,Z).     :- f(X,Y), f(Y,Z), not eq(X,Z), not alt(X,Z), not f(X,Z).
:- eq(X,Y), i(Y,Z), not i(X,Z).     :- f(X,Y), i(Y,Z), not s(X,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), dis(Y,Z), not dis(X,Z). :- f(X,Y), dis(Y,Z), not s(X,Z), not i(X,Z), not dis(X,Z).
eq(X,Y) :- fact(eq,X,Y).
f(X,Y) :- fact(f,X,Y).
```

Fig. B 3. Partial CTSA2 encoding for TC-6.

```
{true(X,R,Y) : relation(R)} = 1 :- element(X); element(Y); X != Y.
true(X,eq,X) :- element(X).
:- true(X,R1,Y); true(Y,R2,Z); not true(X,Rout,Z) : table(R1,R2,Rout).
:- possible(X,_,Y); not true(X,R,Y) : possible(X,R,Y).
relation(eq; alt; s; f; i; dis).
table(eq, eq, (eq)).                    table(f, eq, (f)).
table(eq, alt, (alt)).                  table(f, alt, (f)).
table(eq, s, (s)).                      table(f, s, (i;dis)).
table(eq, f, (f)).                      table(f, f, (eq;alt;f)).
table(eq, i, (i)).                      table(f, i, (s;i;dis)).
table(eq, dis, (dis)).                  table(f, dis, (s;i;dis)).
```

Fig. B 4. Partial GEN encoding for TC-6.

```
{ s(X,Z) ; f(X,Z) ; ex(X,Z); ex(Z,X) ; alt(X,Z) ; ret(X,Z) ; rev(X,Z) ;  i(X,Z) ; eq(X,Z) ;
 dis(X,Z) }=1 :- traj(X), traj(Z), X!=Z.
eq(X,X) :- traj(X).
eq(X,Z) :- eq(X,Y), eq(Y,Z).     f(X,Z) :- f(X,Y), eq(Y,Z).
rev(X,Z) :- eq(X,Y), rev(Y,Z).   ex(Z,X) :- f(X,Y), rev(Y,Z).
alt(X,Z) :- eq(X,Y), alt(Y,Z).   f(X,Z) :- f(X,Y), alt(Y,Z).
ret(X,Z) :- eq(X,Y), ret(Y,Z).   ex(Z,Y) :- f(X,Y), ret(Y,Z).
s(X,Z) :- eq(X,Y), s(Y,Z).       ex(X,Z) | i(X,Z) | dis(X,Z) :- f(X,Y), s(Y,Z).
f(X,Z) :- eq(X,Y), f(Y,Z).       eq(X,Z) | alt(X,Z) | f(X,Z) :- f(X,Y), f(Y,Z).
ex(X,Z) :- eq(X,Y), ex(Y,Z).     s(X,Z) | i(X,Z) | dis(X,Z):- f(X,Y), ex(Y,Z).
ex(Z,X) :- eq(X,Y), ex(Z,Y).     rev(X,Z) | ret(X,Z) | ex(Z,X) :- f(X,Y), ex(Z,Y).
i(X,Z) :- eq(X,Y), i(Y,Z).       s(X,Z) | ex(X,Z) | i(X,Z) | dis(X,Z) :- f(X,Y), i(Y,Z).
dis(X,Z) :- eq(X,Y), dis(Y,Z).   s(X,Z) | ex(X,Z) | i(X,Z) | dis(X,Z) :- f(X,Y), dis(Y,Z).
:- eq(X,Z), alt(X,Z).            :- f(X,Z), alt(X,Z).
:- eq(X,Z), i(X,Z).              :- f(X,Z), i(X,Z).
:- eq(X,Z), s(X,Z).              :- f(X,Z), eq(X,Z).
:- eq(X,Z), f(X,Z).              :- f(X,Z), dis(X,Z).
:- eq(X,Z), dis(X,Z).            :- f(X,Z), ex(X,Z).
:- eq(X,Z), ex(X,Z).             :- f(X,Z), ex(Z,X).
:- eq(X,Z), ex(Z,X).             :- f(X,Z), rev(X,Z).
:- eq(X,Z), rev(X,Z).            :- f(X,Z), ret(X,Z).
:- eq(X,Z), ret(X,Z).            :- f(X,Z), s(X,Z).
```

Fig. B 5. Partial COI7 encoding for TC-10.

```
{s(X,Y); f(X,Y); ex(X,Y); exi(X,Y); alt(X,Y); ret(X,Y); rev(X,Y); i(X,Y); eq(X,Y);
 dis(X,Y)}=1 :- traj(X), traj(Y), X<Y.
eq(X,X) :- traj(X).
:- eq(X,Y), eq(Y,Z), not eq(X,Z).   :- f(X,Y), eq(Y,Z), not f(X,Z).
:- eq(X,Y), rev(Y,Z),not rev(X,Z).  :- f(X,Y), rev(Y,Z), not exi(X,Z).
:- eq(X,Y), alt(Y,Z), not alt(X,Z). :- f(X,Y), alt(Y,Z), not f(X,Z).
:- eq(X,Y), ret(Y,Z), not ret(X,Z). :- f(X,Y), ret(Y,Z), not exi(X,Z).
:- eq(X,Y), s(Y,Z), not s(X,Z).     :- f(X,Y), s(Y,Z), not ex(X,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), f(Y,Z), not f(X,Z).     :- f(X,Y), f(Y,Z), not eq(X,Z), not alt(X,Z), not f(X,Z).
:- eq(X,Y), ex(Y,Z), not ex(X,Z).   :- f(X,Y), ex(Y,Z), not s(X,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), exi(Y,Z), not exi(X,Z).
:- eq(X,Y), i(Y,Z), not i(X,Z).
:- eq(X,Y), dis(Y,Z), not dis(X,Z).
:- f(X,Y), exi(Y,Z), not rev(X,Z), not ret(X,Z), not exi(X,Z).
:- f(X,Y), i(Y,Z), not s(X,Z), not ex(X,Z), not i(X,Z), not dis(X,Z).
:- f(X,Y), dis(Y,Z), not s(X,Z), not ex(X,Z), not i(X,Z), not dis(X,Z).
exi(X,Y) :- ex(Y,X), Y<X.
ex(X,Y) :- exi(Y,X), Y<X.
```

Fig. B 6. Partial CTSA encoding for TC-10.

```
{s(X,Y); f(X,Y); ex(X,Y); exi(X,Y); alt(X,Y); ret(X,Y); rev(X,Y); i(X,Y); eq(X,Y);
 dis(X,Y)}=1 :- traj(X), traj(Y), X<Y, #count{R : fact(R,X,Y)} = 0.
eq(X,X) :- traj(X).
:- eq(X,Y), eq(Y,Z), not eq(X,Z).   :- f(X,Y), s(Y,Z), not ex(X,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), rev(Y,Z),not rev(X,Z).  :- f(X,Y), f(Y,Z), not eq(X,Z), not alt(X,Z), not f(X,Z).
:- eq(X,Y), alt(Y,Z), not alt(X,Z). :- f(X,Y), ex(Y,Z), not s(X,Z), not i(X,Z), not dis(X,Z).
:- eq(X,Y), ret(Y,Z), not ret(X,Z).
:- eq(X,Y), s(Y,Z), not s(X,Z).
:- eq(X,Y), f(Y,Z), not f(X,Z).
:- eq(X,Y), ex(Y,Z), not ex(X,Z).
:- eq(X,Y), exi(Y,Z), not exi(X,Z).
:- eq(X,Y), i(Y,Z), not i(X,Z).
:- eq(X,Y), dis(Y,Z), not dis(X,Z).
:- f(X,Y), eq(Y,Z), not f(X,Z).
:- f(X,Y), rev(Y,Z), not exi(X,Z).
:- f(X,Y), alt(Y,Z), not f(X,Z).
:- f(X,Y), ret(Y,Z), not exi(X,Z).
:- f(X,Y), exi(Y,Z), not rev(X,Z), not ret(X,Z), not exi(X,Z).
:- f(X,Y), i(Y,Z), not s(X,Z), not ex(X,Z), not i(X,Z), not dis(X,Z).
:- f(X,Y), dis(Y,Z), not s(X,Z), not ex(X,Z), not i(X,Z), not dis(X,Z).
eq(X,Y) :- fact(eq,X,Y).
f(X,Y) :- fact(f,X,Y).
```

Fig. B 7. Partial CTSA2 encoding for TC-10.

```
{true(X,R,Y) : relation(R)} = 1 :- element(X); element(Y); X != Y.
true(X,eq,X) :- element(X).
:- true(X,R1,Y); true(Y,R2,Z); not true(X,Rout,Z) : table(R1,R2,Rout).
:- possible(X,_,Y); not true(X,R,Y) : possible(X,R,Y).
relation(eq; rev; alt; ret; s; f; ex; exi; i; dis).
table(eq, eq, (eq)).                  table(f, eq, (f)).
table(eq, rev, (rev)).                table(f, rev, (exi)).
table(eq, alt, (alt)).                table(f, alt, (f)).
table(eq, ret, (ret)).                table(f, ret, (exi)).
table(eq, s, (s)).                    table(f, s, (ex;i;dis)).
table(eq, f, (f)).                    table(f, f, (eq;alt;f)).
table(eq, ex, (ex)).                  table(f, ex, (s;i;dis)).
table(eq, exi, (exi)).                table(f, exi, (rev;ret;exi)).
table(eq, i, (i)).                    table(f, i, (s;ex;i;dis)).
table(eq, dis, (dis)).                table(f, dis, (s;ex;i;dis)).
```

Fig. B 8. Partial GEN encoding for TC-10.