Advanced Topics in Concurrent Systems
DM869

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Contents

Introduction to inference systems

Rules

Theorem 1. $\frac{\text{ﬃ}}{num(Z)}[Zero]$

Theorem 2. $\frac{num(Z)}{num(Sx)}[Succ]$

num(Z)

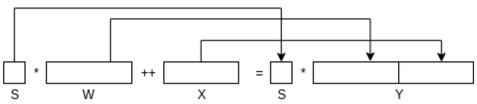
Num(Z) is derivable iff x encodes a nautral number, if any derivation for number x has exatly height n, then x encodes n proff by induction, on the structure pf the given deviration for num(x)
Care Zero The derivation starts with rule[Zero] hence X must be >, the height must be 1
case one Num(Z) is derivable iff x encodes a nautral number, if any derivation for number x has exatly height n+1, then x encodes n proff by induction, on the structure pf the given deviration for num(x)
Care Zero The derivation starts with rule[Zero] hence X must be n+1, the height must be n+1

succ

Case Zero
The derivation rulestarts with rule[succ] hence X=Sy for somey, we have a derivation for num(Y), Its height, Say m.
By induction HP, y encodes m-1 thus Sy, encodes m-1

Add

Theorem 3. $\frac{add(w,x,y)}{add(Sw,X,Sy)}[Succ]$



add(W,X,Y) is derivable iff W+X = Y
Prove by induction on the derication of add(W,X,Y)
Case +ℤ There is no inductive step
W = Z, X = x = Y, O+X=X
Case +S W= Sw, X = x, Y = Sy,
We have a serivation for add(w,x,y) We can apply the inductive hypothesis(ind. HP) w+x=y, W=1+w, Y=1+y, we conclude that 1+w+x=1+y, W+X =Y

sub

Theorem 4. $\frac{num(Z)}{num(Sx)}[Succ]$

sub(w,x,y) def, rules s.t. sub(q,x,y) is derivable iff w-x=y.
It can be proved that there is no proof for this.

if then

Theorem 5. $\frac{if x+y=z}{then w-x=y}\frac{add(x,y,w)}{sub(w,x,y)}$

Conculus of the cumunication system

C is a channel
C = new channel ("IP eg 10.130.10.42")
C.open(); connect C.send(42);
x: c.recv() P:
Def. a labelled transition sstem is (S, L, $\rightarrow$)

- S is a set of steates (processes)
- K us a set of lables (Actions)
- $\rightarrow \subseteq S \times L \times S$ is trasition relation

Natation S $\xrightarrow{e}$ S' means (S,e, S')$\in\rightarrow$

$P ::= \emptyset$ //Termination program
$\overline{C}.P$ //send on channel c and continue as P
$\overline{C}.P$ // Recieve on channel c and continue as P

$\dfrac{}{C.P \xrightarrow{c} P}$ [Send]

$\dfrac{}{\overline{C}.P \xrightarrow{\overline{c}} P}$ [Recieve]

$\dfrac{P \xrightarrow{c} P' \qquad Q \xrightarrow{a} Q'}{P|Q \xrightarrow{t} P'|Q'}$ [Com]

How can i see that two programs are running at the same time.
P | Q // P and Q urn concurrently
$c.P|\overline{C}.Q \rightarrow P|Q$ //If we have two nodes, c, and $\overline{c}$ and c wants to send to $\overline{c}$ and $\overline{c}$ want's to recieve from c, this is syncronys transmition. eg, a communication can't fail.