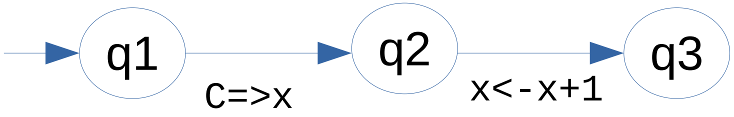
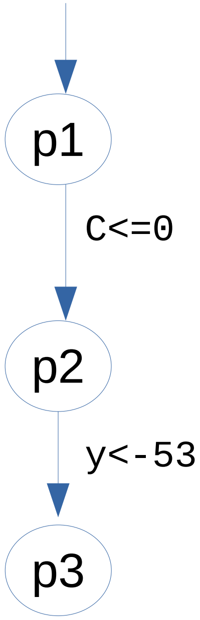
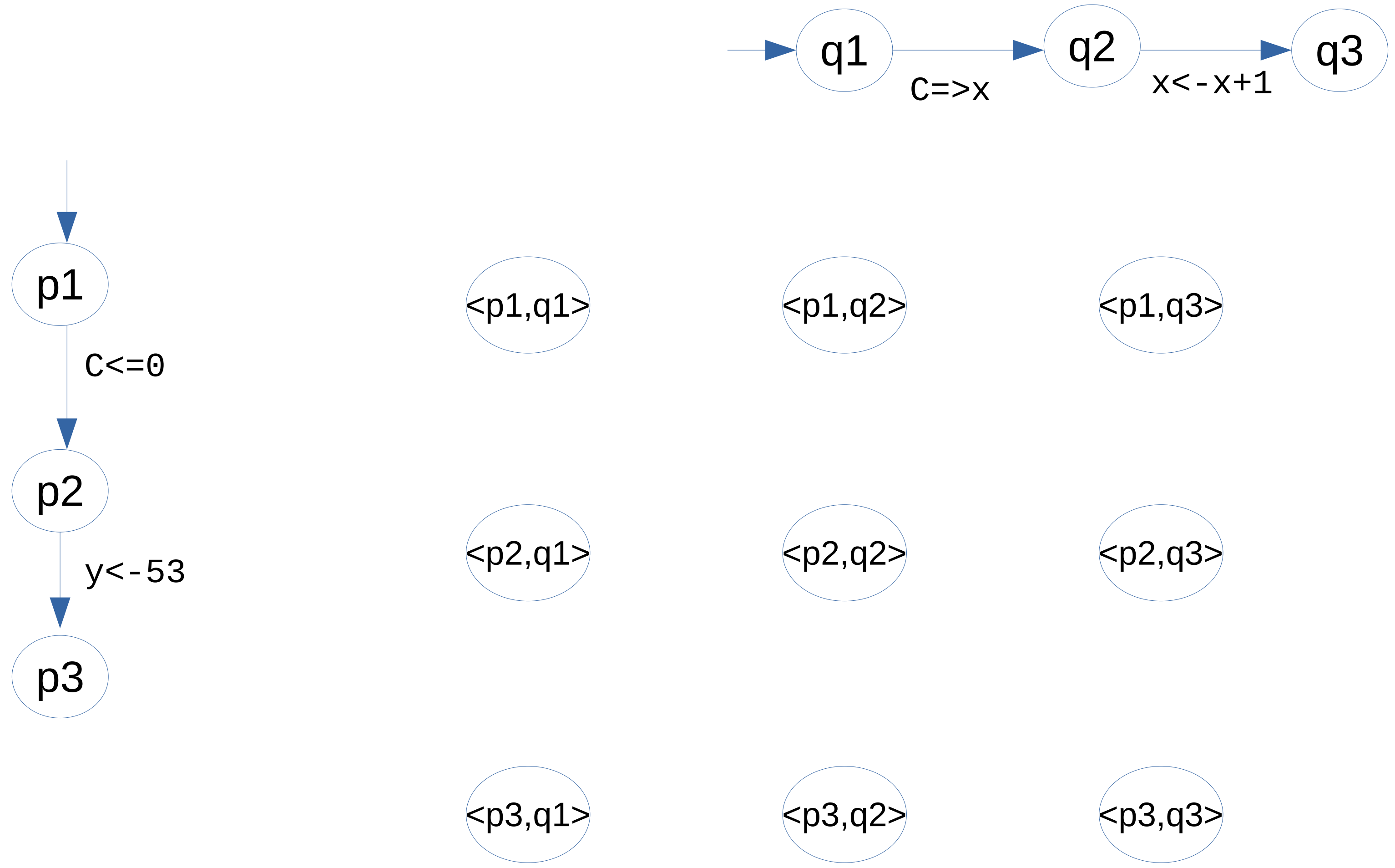


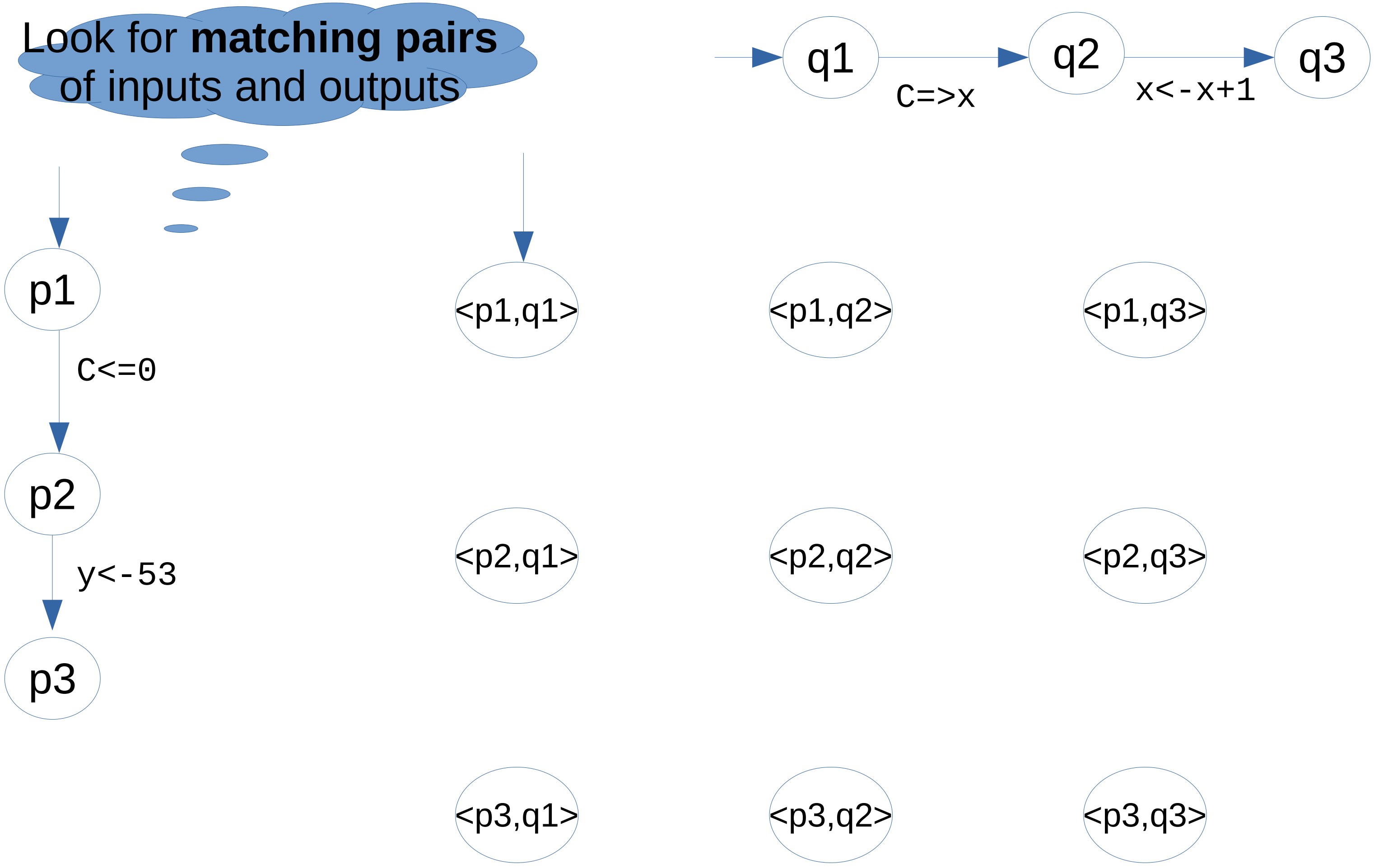

Closed product:

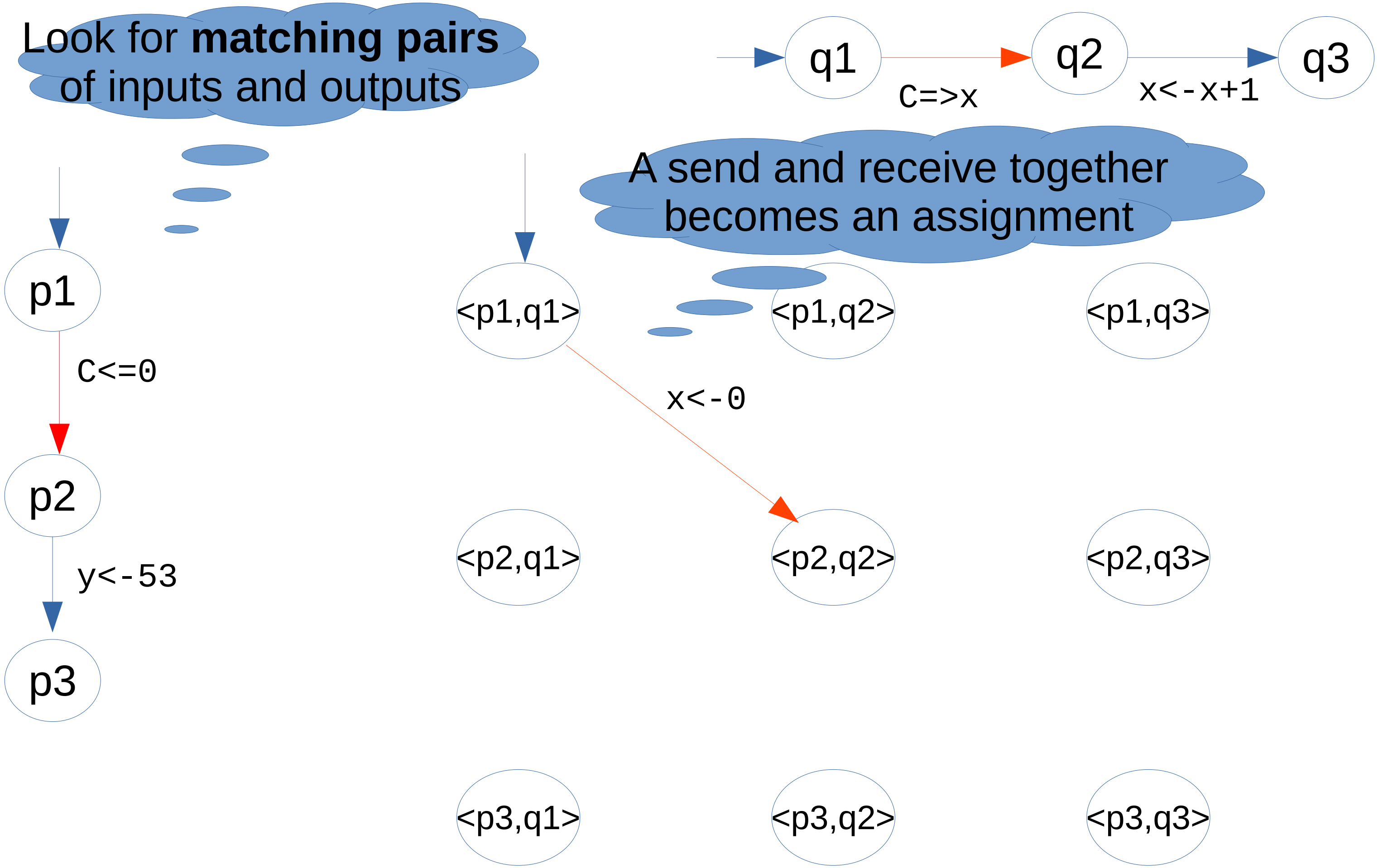
All the behaviours that p||q could engage in,
if they are the only processes in the world.

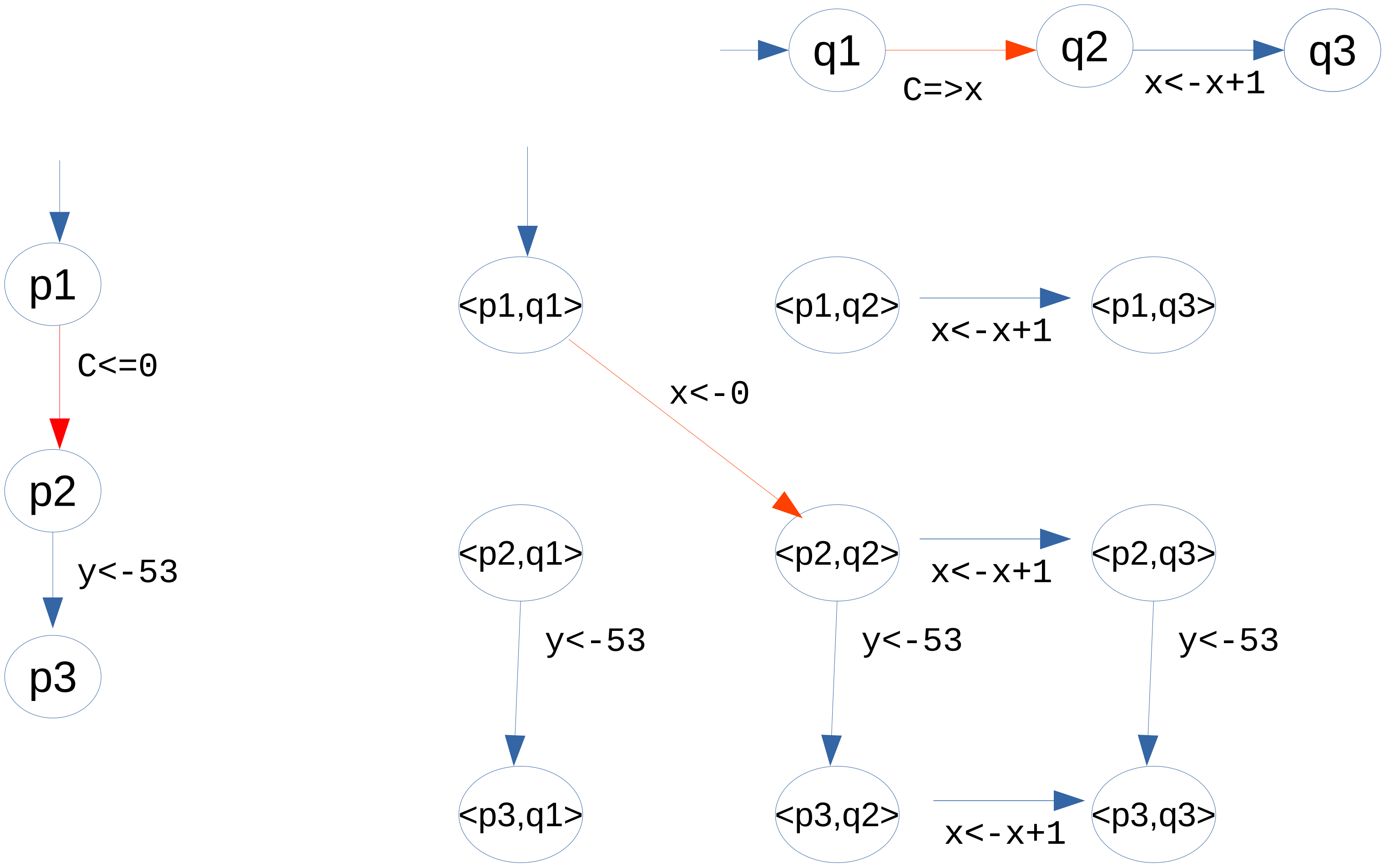
If you have some send/receives that can’t be matched
by others in our closed world, they are ignored.

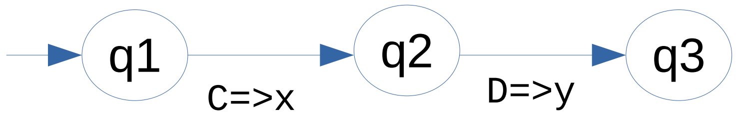


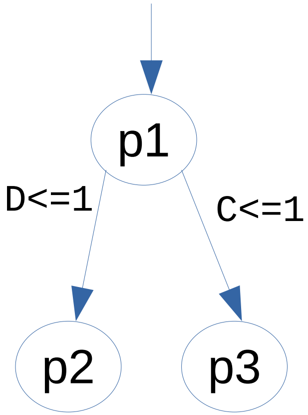
q1
C=>x
q2
x<-x+1
q3
p1
C<=0
p2
y<-53
p3
<p1,q1>
<p1,q2>
<p1,q3>
<p2,q1>
<p2,q2>
<p2,q3>
<p3,q1>
<p3,q2>
<p3,q3>

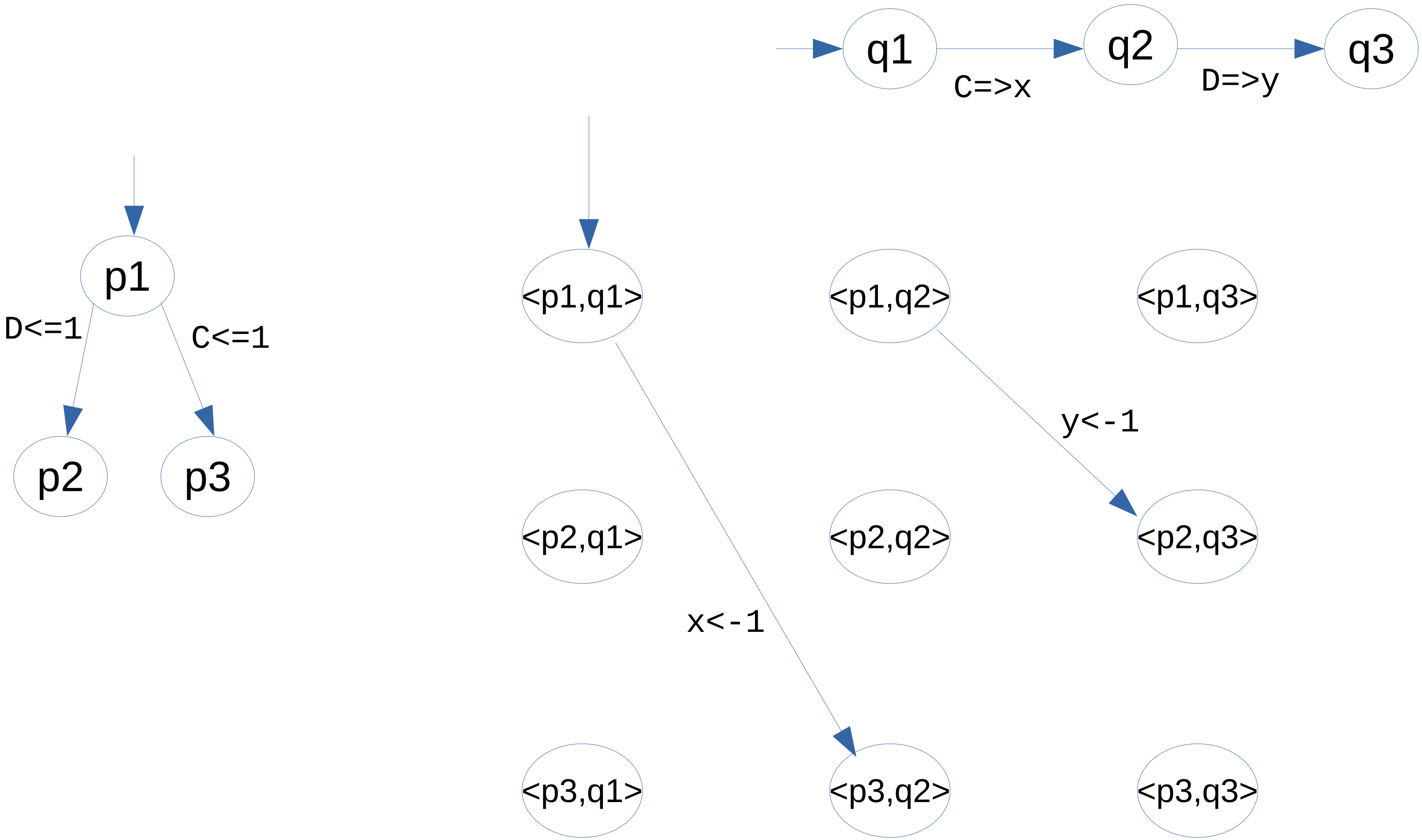

Look for **matching pairs** of inputs and outputs
q1
C=>x
q2
x<-x+1
q3
p1
C<=0
p2
y<-53
p3
<p1,q1>
<p1,q2>
<p1,q3>
<p2,q1>
<p2,q2>
<p2,q3>
<p3,q1>
<p3,q2>
<p3,q3>


Look for **matching pairs** of inputs and outputs
q1
q2
q3
C=>x
x<-x+1
A send and receive together becomes an assignment
p1
p2
p3
C<=0
y<-53
<p1,q1>
<p1,q2>
<p1,q3>
x<-0
<p2,q1>
<p2,q2>
<p2,q3>
<p3,q1>
<p3,q2>
<p3,q3>

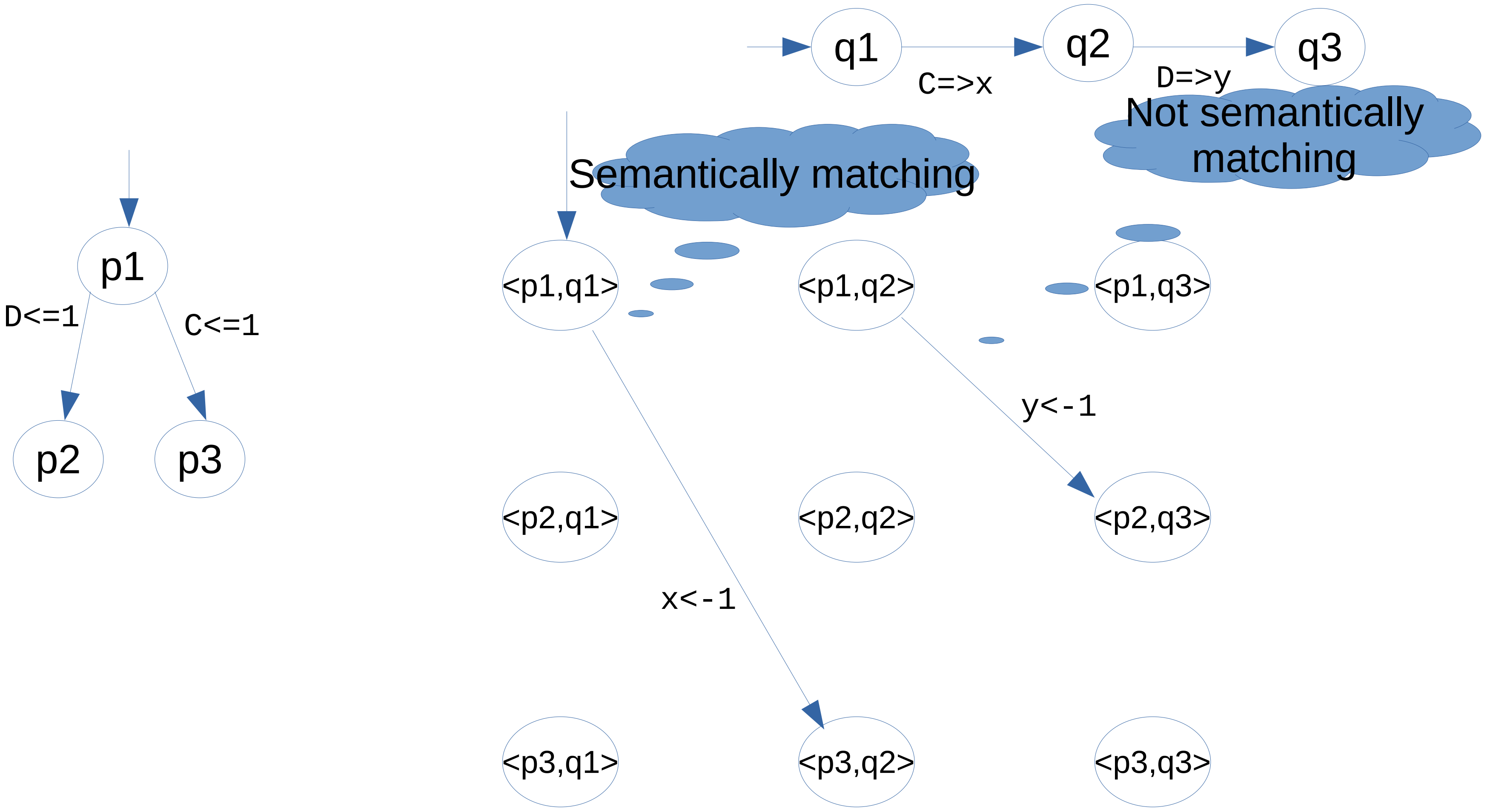

q1
q2
q3
C=>x
x<-x+1
p1
p2
p3
C<=0
y<-53
<p1,q1>
<p1,q2>
<p1,q3>
x<-x+1
x<-0
<p2,q1>
<p2,q2>
<p2,q3>
x<-x+1
y<-53
y<-53
y<-53
<p3,q1>
<p3,q2>
<p3,q3>
x<-x+1

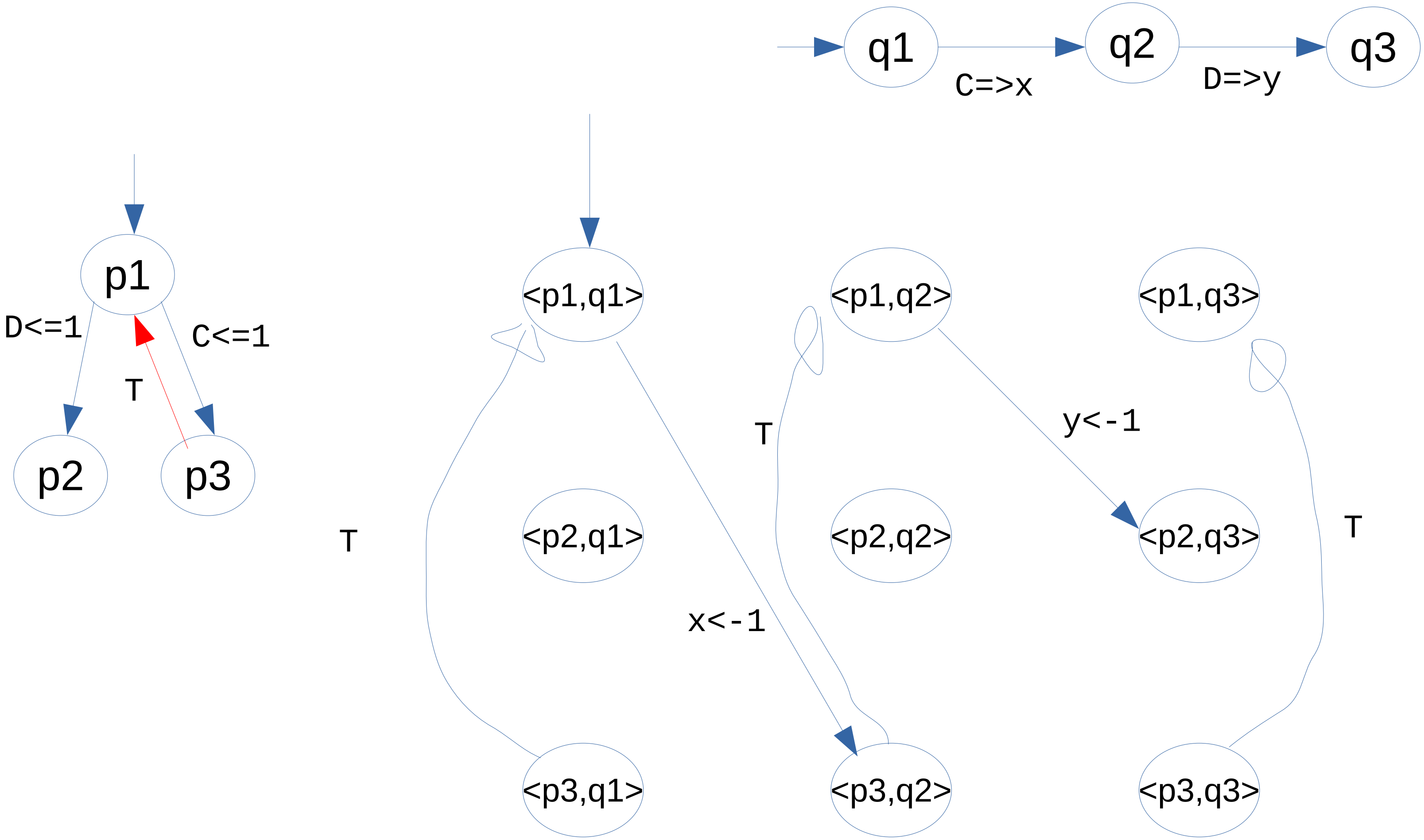

q1
C=>x
q2
D=>y
q3


p1
D<=1
C<=1
p2
p3

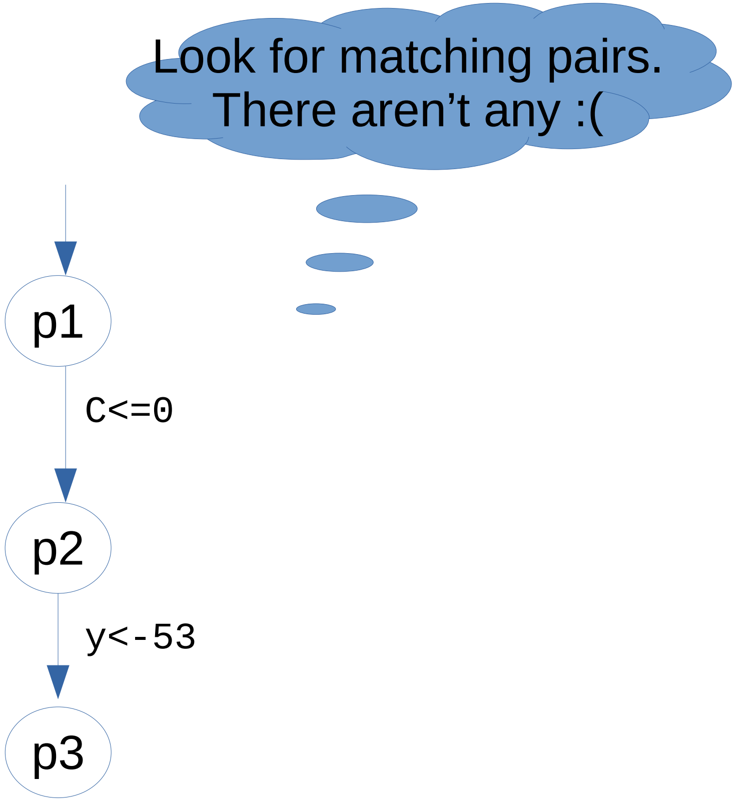


q1
q2
q3
C=>x
D=>y
p1
p2
p3
D<=1
C<=1
<p1,q1>
<p1,q2>
<p1,q3>
<p2,q1>
<p2,q2>
<p2,q3>
<p3,q1>
<p3,q2>
<p3,q3>
y<-1
x<-1

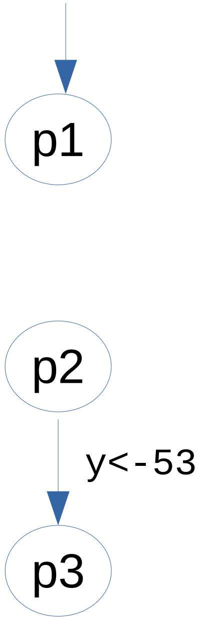

q1
q2
q3
C=>x
D=>y
Not semantically matching
Semantically matching
p1
D<=1
C<=1
p2
p3
<p1,q1>
<p1,q2>
<p1,q3>
y<-1
<p2,q1>
<p2,q2>
<p2,q3>
x<-1
<p3,q1>
<p3,q2>
<p3,q3>

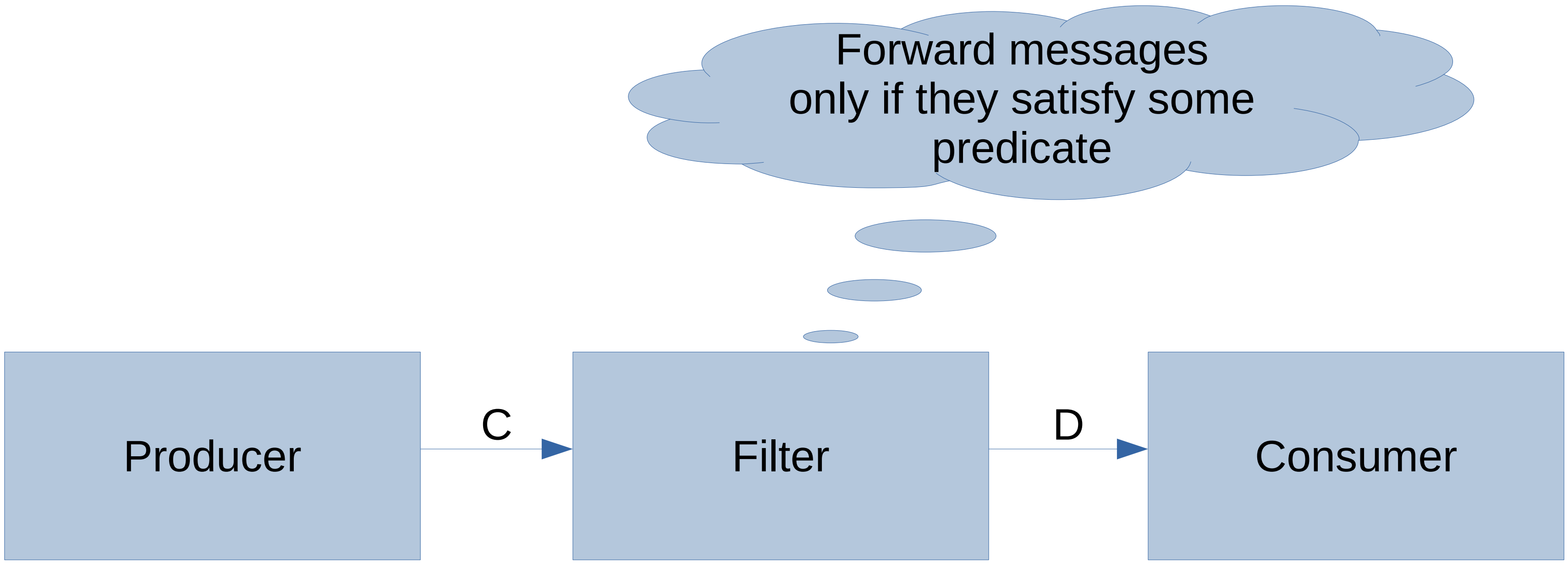


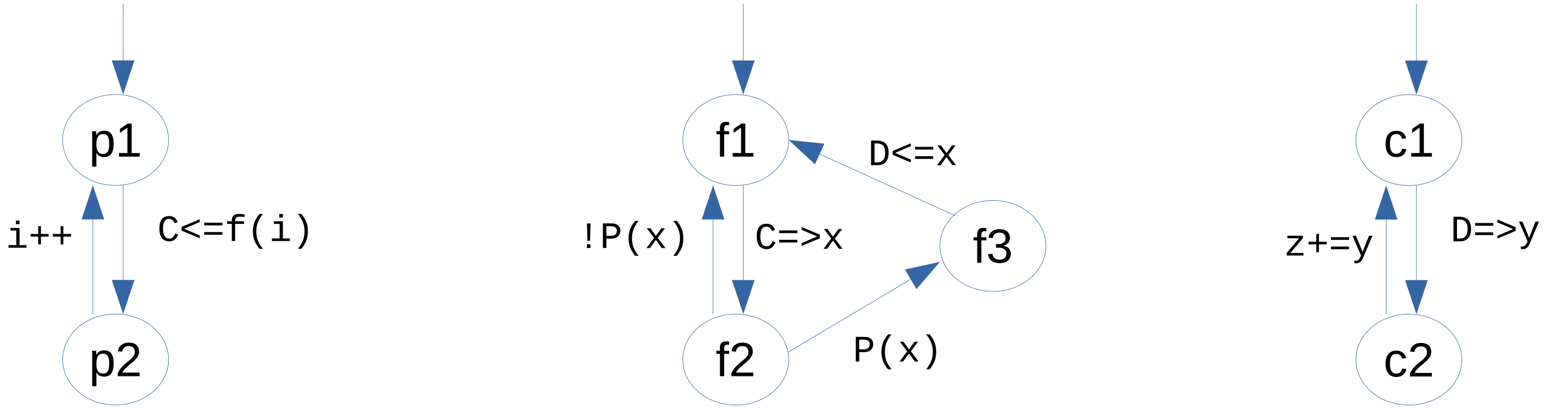
q1
q2
q3
C=>x
D=>y
p1
p2
p3
D<=1
C<=1
T
<p1,q1>
<p1,q2>
<p1,q3>
<p2,q1>
<p2,q2>
<p2,q3>
<p3,q1>
<p3,q2>
<p3,q3>
T
T
T
x<-1
y<-1




## Unary closed product




Forward messages
only if they satisfy some
predicate
Producer
C
Filter
D
Consumer


p1
p2
i++
C<=f(i)
f1
f2
f3
!P(x)
C=>x
D<=x
P(x)
c1
c2
z+=y
D=>y

Invariant: when we’re in <p1,f1,c1> then:

z = Sum_{n : 0 <= n < i /\ P(f(i)} f(n)