Solutions for CP Exercises, September 8

1. Solution for Trans.3

(1)	$a_1\ b_1\ b_2\ c_1$	(7)	$b_1\ c_1\ b_2\ a_1$
(2)	$a_1\ b_1\ c_1\ b_2$	(8)	$b_1\ b_2\ a_1\ c_1$
(3)	$a_1\ c_1\ b_1\ b_2$	(9)	$b_1\ b_2\ c_1\ a_1$
(4)	$b_1\ a_1\ b_2\ c_1$	(10)	$c_1\ a_1\ b_1\ b_2$
(5)	$b_1\ a_1\ c_1\ b_2$	(11)	$c_1\ b_1\ a_1\ b_2$
(6)	$b_1\ c_1\ a_1\ b_2$	(12)	$c_1\ b_1\ b_2\ a_1$

2. Solution for Trans.4

Number of interleavings:

$$\frac{(n_1 + n_2 + ... + n_k)!}{n_1! * n_2! * ... * n_k!}$$

This forumula can be obtained by first selecting places for P_1, then for P_2 from the remaining slots etc. and then multiply these possibilities together. The formula then follows by reduction.

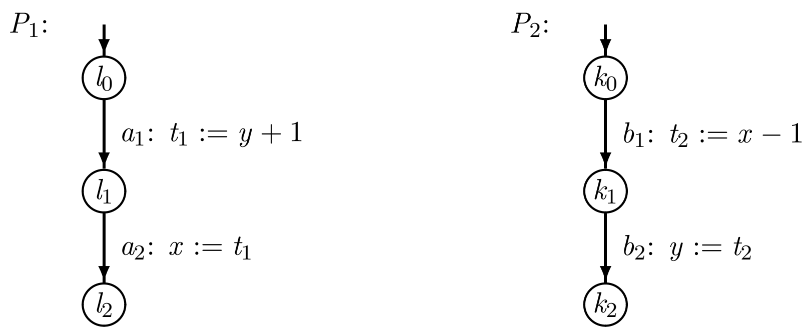
Another, more direct, way to get the formula is to generalize the second argument from the solution for Trans.2.

3. Solution for Trans.5

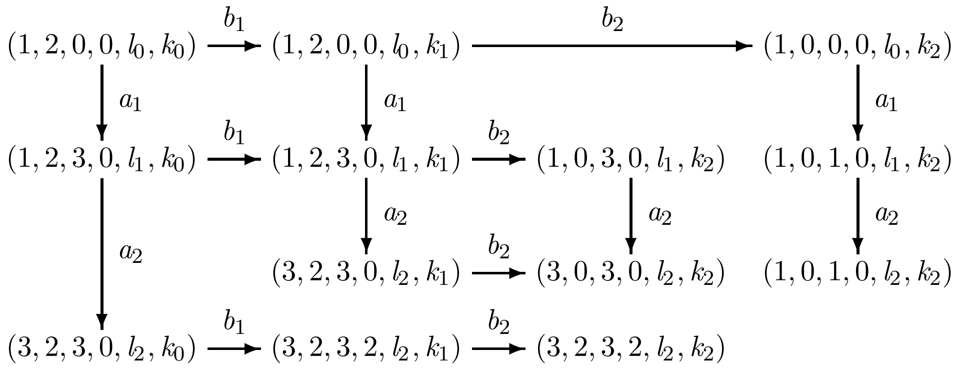
Rewriting to atomic assignment statements:

$x := 1;\ y := 2;$
cobegin
$\quad < t_1 := y + 1 >;\ < x := t_1 > \ \|\ < t_2 := x - 1 >;\ < y := t_2 >$
coend

Or equivalently as transition diagrams:



Let the global state be given by a vector $(x, y, t_1, t_2, \pi_1, \pi_2)$ where π_i is the control pointer for process P_i. Assuming arbitrarily t_1 and t_2 to be initially 0, the transition system for the concurrent systems is given by the transition graph:



By inspection of the final states ($\pi_1 = l_2 \wedge \pi_2 = k_2$) we find the possibilities for (x, y):

$$\{(1,0), (3,0), (3,2)\}$$

4.

Andrews Fig. 2.2: