L2 ↓ South

L1 ⇄ East / West

Vehicles

R G Y R

L3 ↓

L4 ⇄

Pedestrians

R G R

Whole circuit (cycle) is d seconds / i.e day

↳ Time is mod d. 0s today = 0s tomorrow

$10 \leq d \leq 500$. 2 rush hours: 1. [1s → [2s (exclusive, end before)

2. [3s → [4s

$1 < r_1 < r_2 < r_3 < r_4 < d$ | max $r_4 = d - 1$

(rush at least 1 sec)

traffic cycle is $C_n s_n$ except when

$t \in [r_1, r_2[\cup [r_3, r_4[$

↳ C_r seconds

- $d + r_2 - r_1 \mod C_m = 0$ | normal time
- $r_2 - r_1 \mod C_r = 0$ | rush time
- $r_3 - r_2 \mod C_m = 0$ | idem normal
- $r_4 - r_2 \mod C_r = 0$ | rush

$1 \leq C_m, C_r \leq 99$

Start of day $t = 0 sec$ ~~→~~ Start of new cycle

↳ day can end during and start in middle of cycle

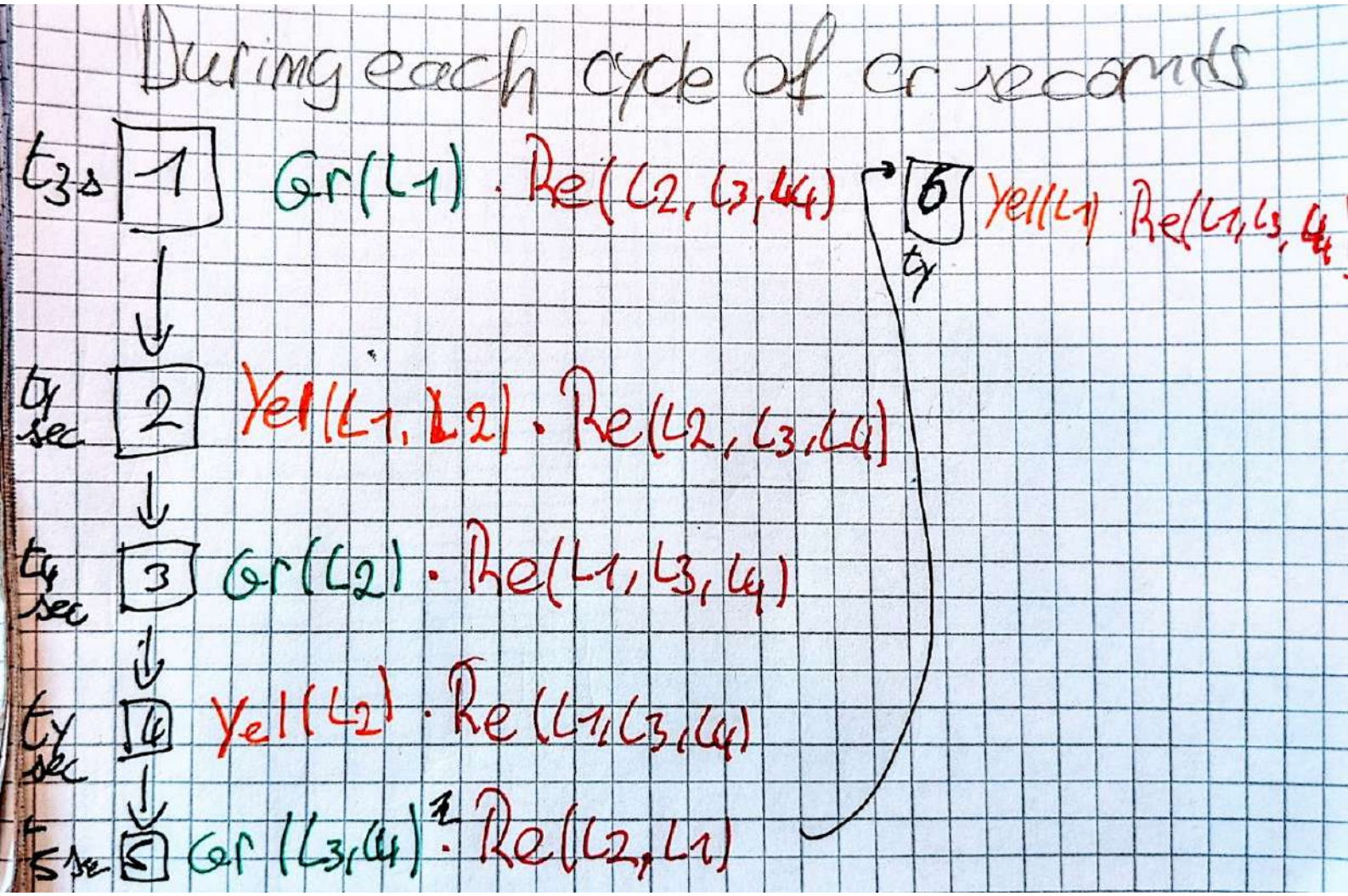
During each cycle of C_m seconds

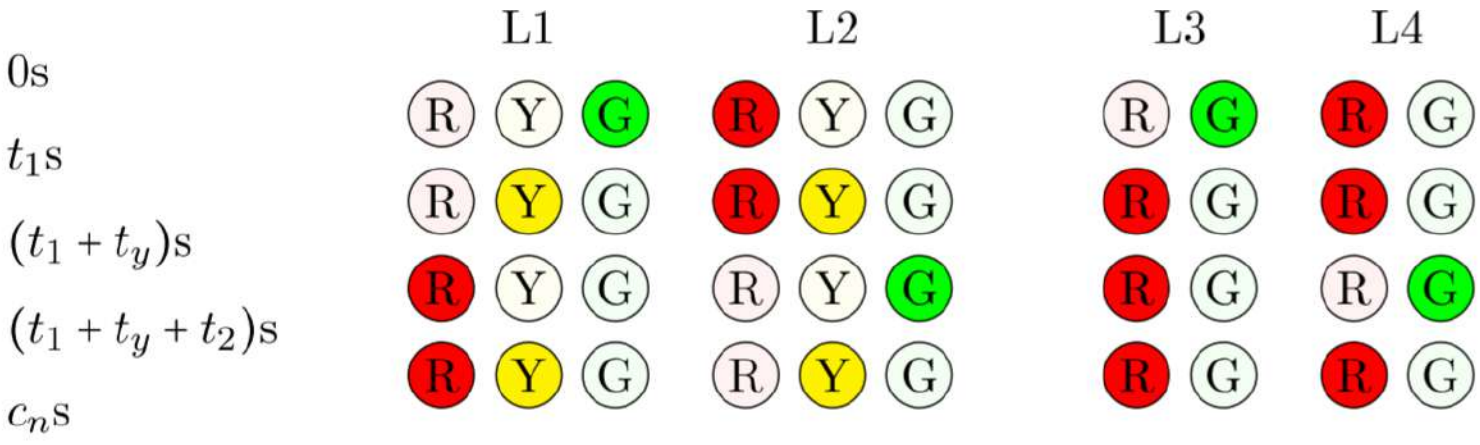
1. $Gr(L_1, L_3, t_1\ sec)$ (others are dim)
   $Re(L_2, L_4, t_1\ sec)$ (" " ")

2. $Yel(L_1, t_y\ sec) \cdot Re(L_3, t_y\ sec)$ (" " ")
   $Yel(L_2, \quad) \cdot Re(L_2, L_4, \quad)$
   Staves

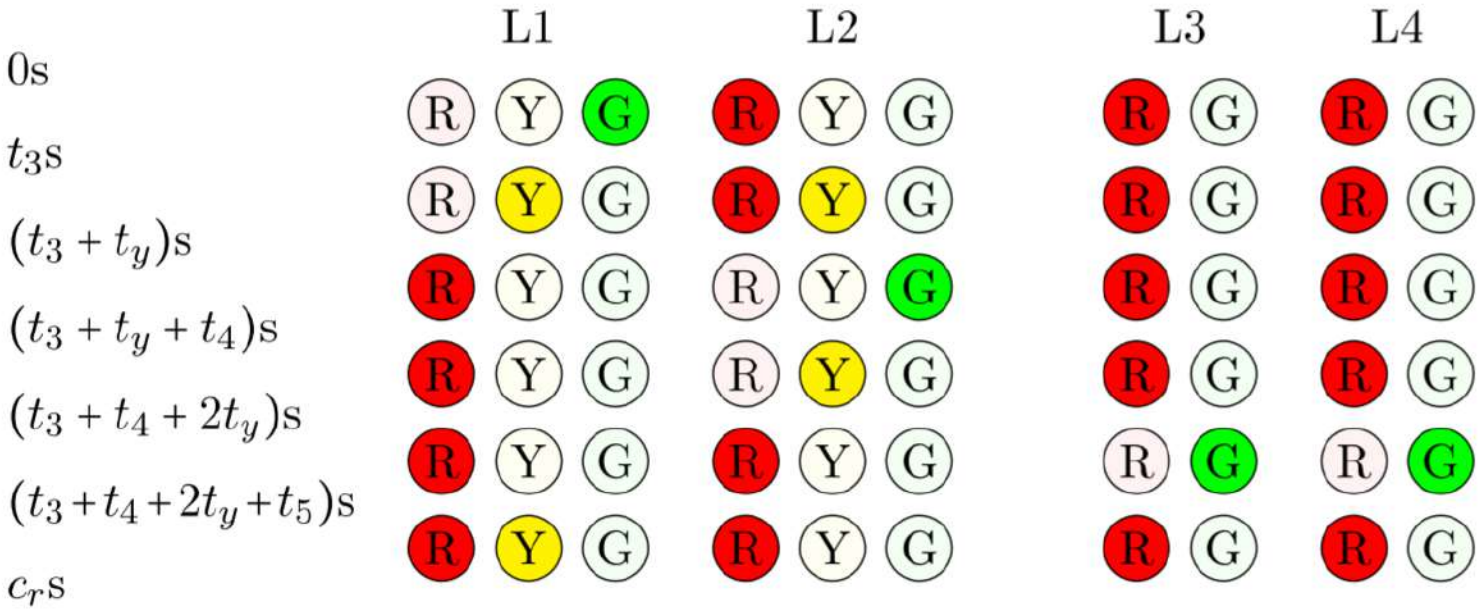
3. $Re(L_4, L_3, t_2\ sec)$
   $Gr(L_2, L_3, t_2\ sec)$

4. $Yel(L_4, L_2) \cdot Re(L_1, L_3 - \frac{t_y}{sec}, L_4)$
   s.t. $t_1 + t_2 + 2 \cdot t_y = C_m$


During each cycle of cr records
1
Gr(L1) · Re(L2, L3, L4)
2
Yel(L1, L2) · Re(L2, L3, L4)
3
Gr(L2) · Re(L1, L3, L4)
4
Yel(L2) · Re(L1, L3, L4)
5
Gr(L3, L4) · Re(L2, L1)
6
Yel(L1) · Re(L1, L3, L4)



(a) Light transition during normal hours.



- Whenever L3 or L4 is green, their seven-segment displays show the remaining green-time in seconds. For example, in the beginning of a normal-hour cycle, the seven-segment display of L3 counts down from t_1 to 0. As soon as the count-down goes to 0, L3 turns red and the seven-segment display turns off (hence we actually cannot see the "0"). Assume that t_1, t_2 and t_5 are smaller than 10 so that one decimal digit is always enough.

In addition to the main traffic light system, there are a few signals required for easier debugging and grading:

- An LED blinking every second, being bright in the first half second and dim in the second half. (You can assume the number of clock cycles in a second is even, thus there is no rounding issue.)

- An LED showing whether it is currently a rush hour or not.

- Two seven-segment displays showing the elapsed time in each traffic cycle, i.e., how many seconds have passed after the start of the current cycle.

Upon reset, the system should start being at r_1s of a day, i.e., at the beginning of the first rush-hour period.