Operating Systems
Assignment #6

Problem 6.1: safe states

$$N = \begin{bmatrix} 1 & 0 & 0 & 2 & 1 \\ 3 & 3 & 7 & 8 & 0 \\ 4 & 2 & 3 & 7 & 1 \\ 3 & 0 & 3 & 4 & 5 \\ 0 & 0 & 0 & 2 & 4 \end{bmatrix}$$

$u = (5, 17, 9, 7, 4)$

$t = (6, 17, 9, 9, 7)$

$a = t - u = (1, 0, 0, 2, 3)$

Need ≤ available => available + allocation

$P0 = \langle 1,0,0,2,1 \rangle \leq \langle 1,0,0,2,3 \rangle \Rightarrow \langle 1,0,0,2,3 \rangle + \langle 1,5,3,1,1 \rangle$
$\Rightarrow \langle 2,5,3,3,4 \rangle$

$P1 = \langle 3,3,7,8,0 \rangle \leq \langle 2,5,3,3,4 \rangle$ X

$P2 = \langle 4,2,3,7,1 \rangle \leq \langle 2,5,3,3,4 \rangle$ X

$P3 = \langle 3,0,3,4,5 \rangle \leq \langle 2,5,3,3,4 \rangle$ X

$P4 = \langle 0,0,0,2,4 \rangle \leq \langle 2,5,3,3,4 \rangle \Rightarrow \langle 2,5,3,3,4 \rangle + \langle 1,2,3,2,1 \rangle$
$\Rightarrow \langle 3,7,6,5,5 \rangle$

$P1 = \langle 3,3,7,8,0 \rangle \leq \langle 3,7,6,5,5 \rangle$ X

$P2 = \langle 4,2,3,7,1 \rangle \leq \langle 3,7,6,5,5 \rangle$ X

$P3 = \langle 3,0,3,4,5 \rangle \leq \langle 3,7,6,5,5 \rangle$

$\langle 3,7,6,5,5 \rangle + \langle 3,1,1,1,0 \rangle$
$\Rightarrow \langle 6,8,7,6,5 \rangle$

$P1 = \langle 3,3,7,8,0 \rangle \leq \langle 6,8,7,6,5 \rangle$ X

$P2 = \langle 4,2,3,7,1 \rangle \leq \langle 6,8,7,6,5 \rangle$ X

NOT SAFE

Problem 6:2; deadlock detection

$t = (3,2,3,1)$

$u = (1,2,2,1)$

$a = (2,0,1,0)$

Need ≤ available => available + allocation

$P1 = \langle 1,0,0,0 \rangle \leq \langle 2,0,1,0 \rangle \Rightarrow \langle 2,0,1,0 \rangle + \langle 1,1,0,0 \rangle$

$\Rightarrow \langle 3,1,1,0 \rangle$

$P2 = \langle 0,1,0,1 \rangle \leq \langle 3,1,1,0 \rangle$ ~~$\Rightarrow \langle 3,1,1,0 \rangle +$~~

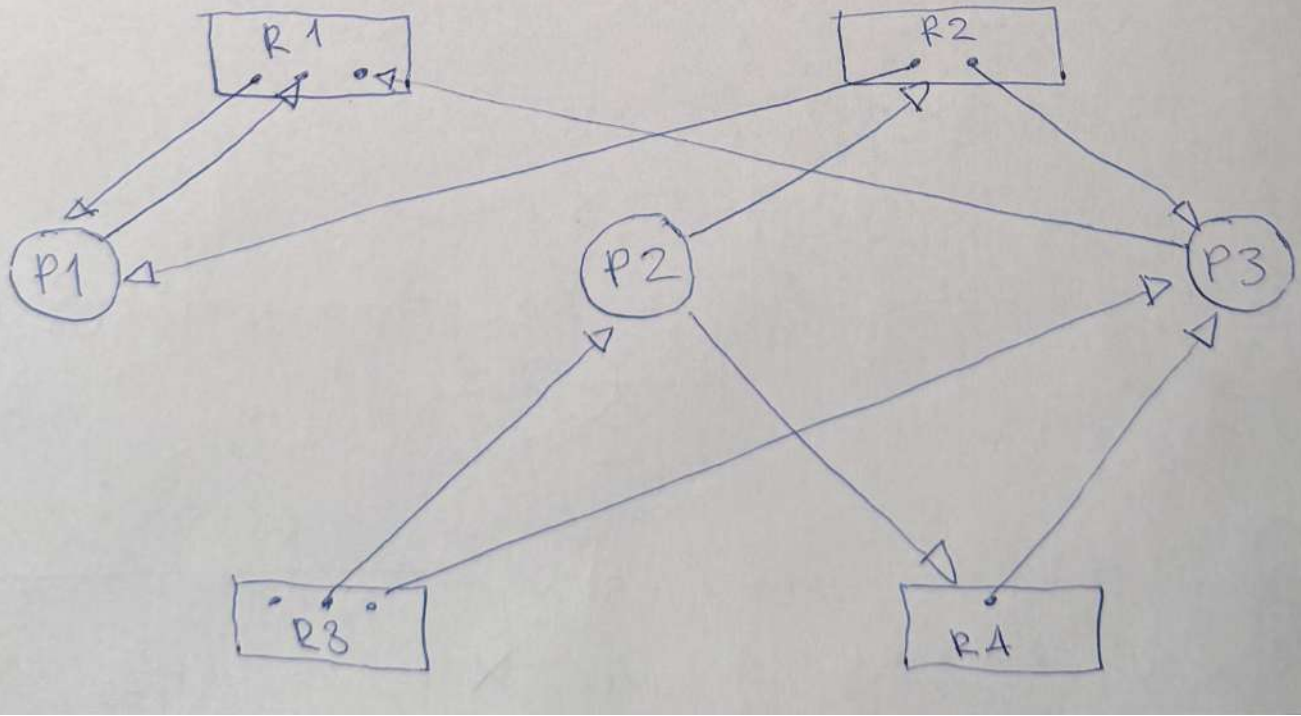
$P3 = \langle 1,0,0,0 \rangle \leq \langle 3,1,1,0 \rangle \Rightarrow \langle 3,1,1,0 \rangle + \langle 0,1,1,1 \rangle$

$\Rightarrow \langle 3,2,2,1 \rangle$

$P2 = \langle 0,1,0,1 \rangle \leq \langle 3,2,2,1 \rangle \Rightarrow \langle 3,2,2,1 \rangle + \langle 0,0,1,0 \rangle$

$\Rightarrow \langle 3,2,3,1 \rangle$

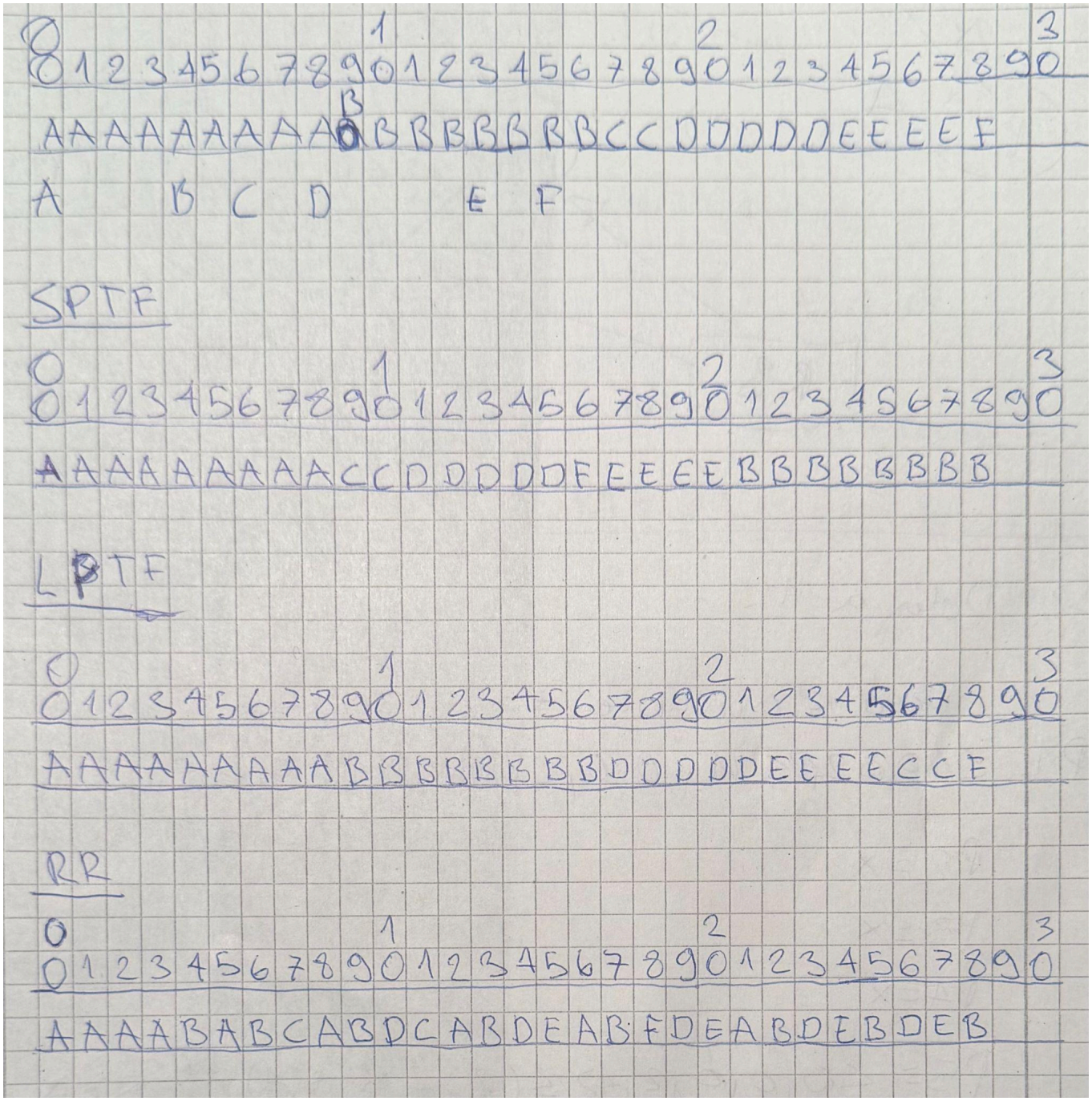
Not deadlocked Sequence is $\langle P1, P3, P2 \rangle$



Problem 6.3: scheduling strategies

The first one is FCFS

a)



b)

FCFS:

i) AVG TURNAROUND TIME: 13.333

ii) AVG WAITING: 8.5

SPTF:

AVG TURNAROUND TIME: 9.5

AVG WAITING: 4.667

LPTF:

AVG TURNAROUND TIME: 14.16

AVG WAITING: 9.33

ROUND ROBIN:

AVG TURNAROUND TIME: 15.167

AVG WAITING: 10.333