

Operating System Assignment #5

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1 Problem 5.1

The system is a safe state, as shown below in the calculation.

The Safe Sequence is $\langle P_1, P_3, P_2, P_0 \rangle$

Process	Allocation	Max	Available	Need
	A B C D E	A B C D E	A B C D E	A B C D E
P ₀	0 2 1 1 1	3 5 8 10 1	3 0 2 6 5	3 3 7 9 0
P ₁	0 5 3 1 1	2 5 3 3 2	2 0 0 2 1	2 0 0 2 1
P ₂	6 7 1 2 1	4 12 4 9 2		4 5 3 7 1
P ₃	3 1 1 1 0	6 1 4 5 5		3 0 3 4 5

P ₀	[3 3 7 9 0] ≤ [3 0 2 6 5] F	New Available A B C D E
P ₁	[2 0 0 2 1] ≤ [3 0 2 6 5] T	[3 5 5 6 7]
P ₂	[4 5 3 7 1] ≤ [3 5 5 6 7] F	Safe Sequence (P ₁ , P ₃ , P ₂ , P ₀)
P ₃	[3 0 3 4 5] ≤ [3 5 5 6 7] T	
P ₀	[3 3 7 9 0] ≤ [6 6 6 7 7] F	
P ₂	[4 5 3 7 1] ≤ [6 6 6 7 7] T	[6 13 7 8 8]
P ₀	[3 3 7 9 0] ≤ [6 13 7 8 8] T	[6 15 8 10 9] = T

Figure 1: 5.1 safe state calculation

2 Problem 5.2

2.1 a

The following is the corresponding resource allocation graph.

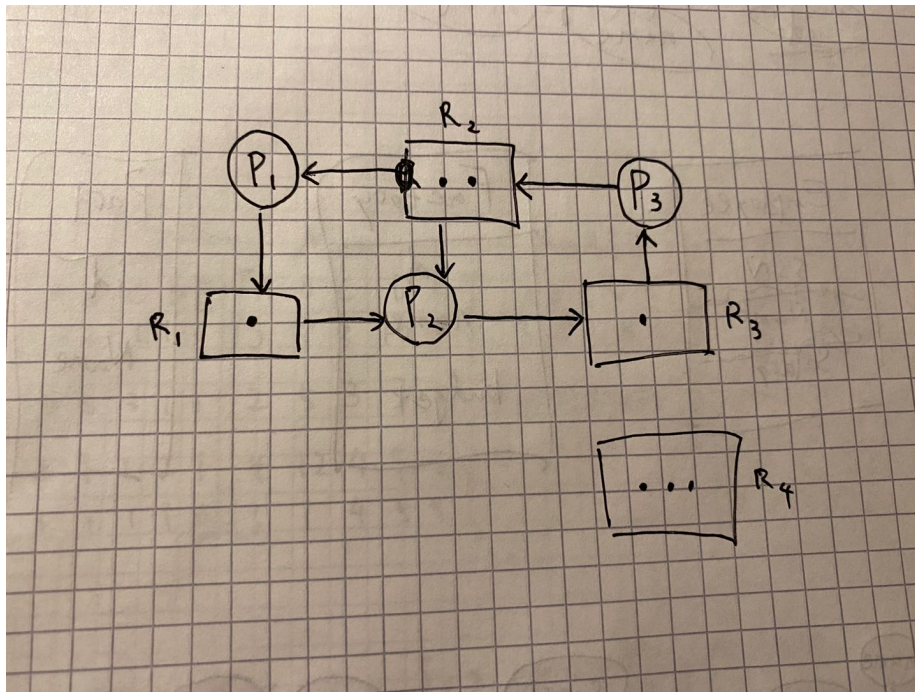
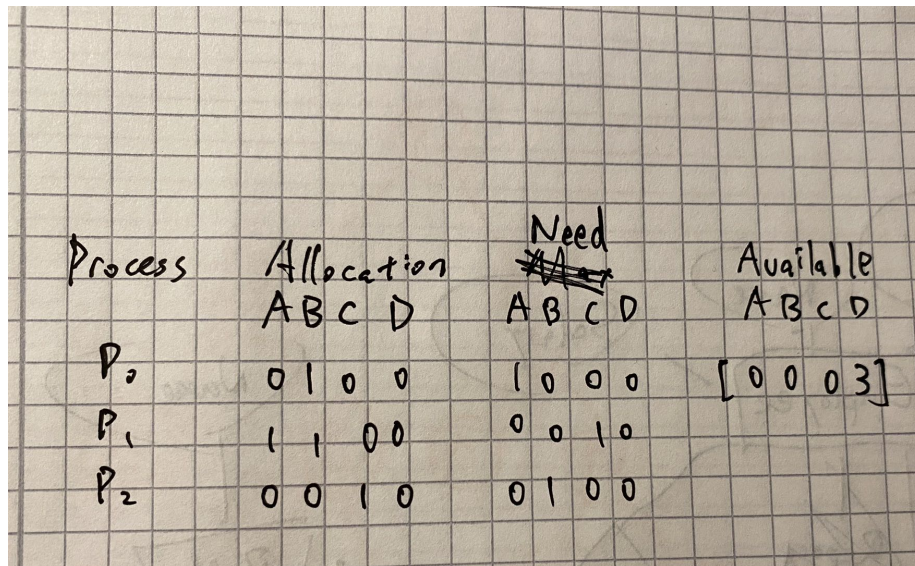


Figure 2: RAG

2.2 b

The system is in deadlock, because the available array is $\langle 0\ 0\ 0\ 3 \rangle$ and this does not satisfy another of the processes.

Also the RAG meets requirement of circular wait for a deadlock to form.



Process	Allocation	Allocation Need	Available
	A B C D	A B C D	A B C D
P ₀	0 1 0 0	1 0 0 0	[0 0 0 3]
P ₁	1 1 0 0	0 0 1 0	
P ₂	0 0 1 0	0 1 0 0	

Figure 3: 5.2 safe state calculation

3 Problem 5.3

3.1 a

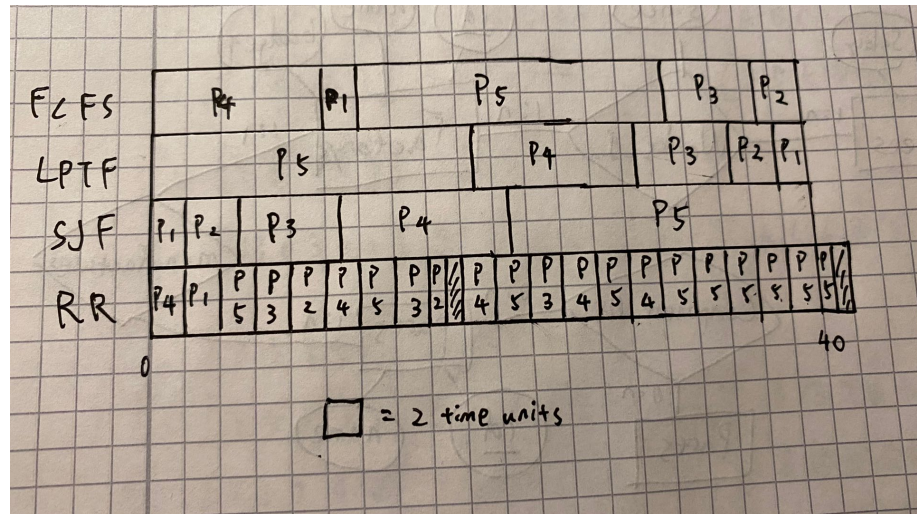


Figure 4: 5.3 Gantt Diagram

3.2 b

FLFS: $(10+12+31+37+40)/5 = 26$ time units

LPTF: $(19+29+35+38+40)/5 = 32.2$ time units

SJF: $(2+5+11+21+40)/5 = 15.8$ time units

RR: $(4+17+24+30+41)/5 = 23.2$ time units

4 Problem 5.4

4.1 a

file	symbol	internal	external	weak symbol	strong symbol
a.c	x		x		x
a.c	y	x		x	
a.c	f	x			x
a.c	g	x			x
b.c	x	x			x
b.c	y	x			x
b.c	f	x			x
b.c	g		x		x

Figure 5: symbols table

4.2 b

This is what will be printed to the standard output.

b.c: f()
a.c: g()
a.c: f()

First, the main function only has access to f() which is in b.c, and that contains g() from a.c. Therefore, the order printed is like above.