Date

NUMERICALS :-

Process	Burst Time.
P_1	24
P_2	3
P_3	3.

* Suppose the processes arrive in same order as given.

Suppose Arrival time is 0

P_1	P_2	P_3
0 (0-23) 24	(24-26) 27	(27-29) 30

Completion time CT	Turn Around time TAT = CT - AT	WT
23	= 23 - 0 = 23	0
26	= 26 - 24 = 2	23
29	= 29 - 27 = 2	26.

Date ________

Shortest Remaining Time First (SRTF) :-
(premptive version)

∴ Assume AT = 0.

Process	AT	BT	CT	TAT = CT - AT	WT
P_1	0	8	17	17 - 0 = 17	10
P_2	1	4	5	5 - 1 = 4	2
P_3	2	9	25	25 - 2 = 23	17
P_4	3	3	10.	10 - 3 = 7	5

Process	AT	BT	CT	TAT = CT - AT	WT
P_1	0	~~8~~ 7			
P_2	1	~~4~~ 3			
P_3	2	~~2~~ ~~1~~ 0			
P_4	3	~~1~~			
P_5	4	3			
P_6	5	~~2~~ 0			

P_1	P_2	P_3	P_3	P_4	P_6	P_2	P_5	P_1
0–1	1–2	2–3	3–4	4–5	5–7 (5-6)	7–10 (7-9)	10–13 (10-12)	13–20 (13-19)

Date

Assume AT = 0.

Process	AT	BT
P_1	0	~~7~~ ~~6~~ 0
P_2	1	~~5~~ ~~4~~ 0
P_3	2	~~3~~ ~~2~~ 0
P_4	3	~~1~~ 0
P_5	4	~~2~~ 0
P_6	5	~~1~~ 0

First Come First Serve (FCFS) :

P_1	P_2	P_3	P_4	P_5	P_6

0 7 12 15 16 18 19

(0-6) (7-11) (12-14) (16-17)

Shortest Job First (~~FJ~~ SJF) : Assume AT = 0

~~| P_1 | P_2 | P_3 | P_4 | P_3 | P_6 | P_5 |~~ P_2 | P_1 |

~~0 1 2 3 4~~

P_1	P_4	P_6	P_5	P_3	P_2

0 7 8 9 11 14 19

(0-6) (9-10) (11-13) (14-18)

SOLO

Date ________

(SRTF)

P1	P2	P3	P4	P3	P6	P5	P2	P1

0 1 2 3 4 6 7 9 13 19

(4-3) (7-2) (9-12) (13-13).

P1	P2	P3	P4	P5	P6	P5	P2	P2	P1

0 1 2 3 4 5 6 7 9 13 19

			CT	TAT 19	RWT
P_1	0	~~7~~ 6	19 ~~[illegible]~~		
P_2	1	~~5~~ 4	13	12	
P_3	2	~~3~~ ~~2~~ 0	6	4	
~~P_4~~	3	~~1~~ 0	4	1	
~~P_5~~	4	~~2~~ ~~1~~ 0	9	5	
~~P_6~~	5	~~1~~ 0	7	2	

Date

Priority Program ~~Counter~~ Allocation :-

Process	P	AT	BT	(CT − AT) TAT	(TAT − BT) WT
P_1	2	0	~~4~~ 3	[illegible]	
P_2	4	1	~~2~~ 1	4	
P_3	6	2	~~3~~ ~~2~~ 0		
P_4	10	3	~~5~~ ~~1~~ 0		
P_5	8	4	~~1~~ 0		
P_6	12(high)	5	~~4~~ 0		
P_7	9	6	~~6~~ 0		

P_1	P_2	P_3	P_4	P_6	P_4	P_7	P_5	P_3	P_2	P_1

0 1 2 3 5 9 12 18 19 21 22 25

Date

Round Robin :- (Time Quanta / Time Slice) :

Time Quanta = 2.

Process	AT	BT	CT	WT	TAT
P_1	0	$\cancel{5}\ \cancel{3}\ \cancel{1}\ 0$	14	9	14
P_2	1	$\cancel{3}\ \cancel{1}\ 0$	12	10	13
P_3	2	$\cancel{1}\ 0$	5	2	3
P_4	3	$\cancel{2}\ 0$	7	2	4
P_5	4	$\cancel{3}\ \cancel{1}\ 0$	13	6	9

P_1	P_2	P_3	P_4	P_5	P_1	P_2	P_5	P_1

0, 2, 4, 5, 7, 9, 11, 12, 13, 14

Time Quanta = 4.

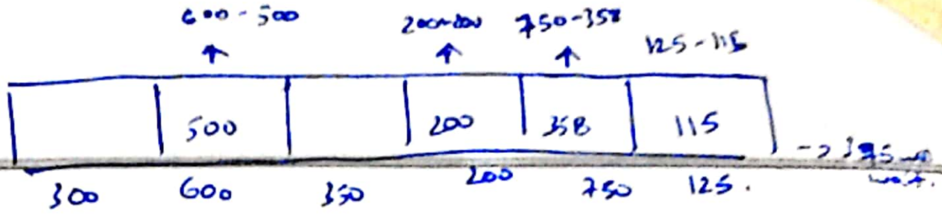
P	AT	BT	CT	TAT	WT
P_1	0	$\cancel{10}\ \cancel{6}\ \cancel{2}\ 0$			
P_2	1	$\cancel{9}\ \cancel{5}\ \cancel{1}\ 0$			
P_3	2	$\cancel{12}\ \cancel{8}\ \cancel{4}\ 0$			
P_4	3	$6\ \cancel{2}\ 0$			

P_1	P_2	P_3	P_4	P_1	P_2	P_3	P_4	P_1	P_2	P_3

0, 4, 8, 12, 16, 20, 24, 28, 30, 32, 33, 37

FF 559
BF 483
WF 659

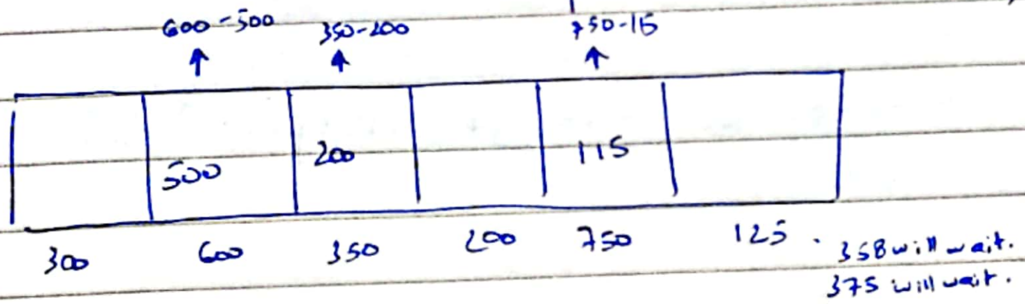
Date

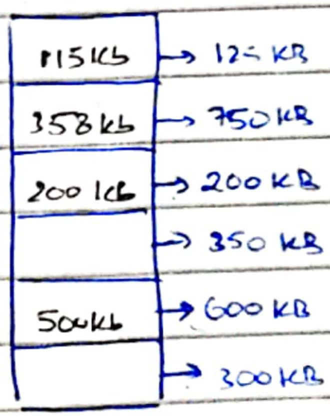


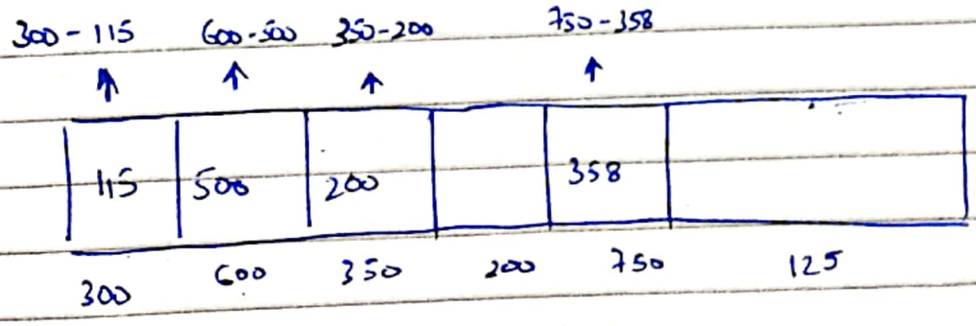
MEMORY PARTITIONS : 300 kb, 600 kb, 350 kb, 200 kb, 750 kb, 125 kb

PROCESS SIZE : 115 kb, 500 kb, 358 kb, 200 kb, 375 kb.

First Fit	Worst Fit	Best Fit
115 kb allocated to 300 kb · 300-115	115 kb allocated to 750 kb - 750-115	115 kb allocated to 125 kb : 125-115
500 kb allocated to 600 kb = 600-500	500 kb " " 600 kb = 600-500	500 kb " " 600 kb : 600-500
358 kb " " 750 kb = 750 - 358	358 kb is waiting. . .	358 kb " " 750 kb : 750-358
200 kb " " 350 kb - 350 - 200	200 " " 350 kb = 350-200	200 kb " " 200 kb = 200-200
375 waiting . . .	375 kb waiting. . . .	375 kb waiting. . . .
829 KB ↙ wastage.	825 KB	502 KB.







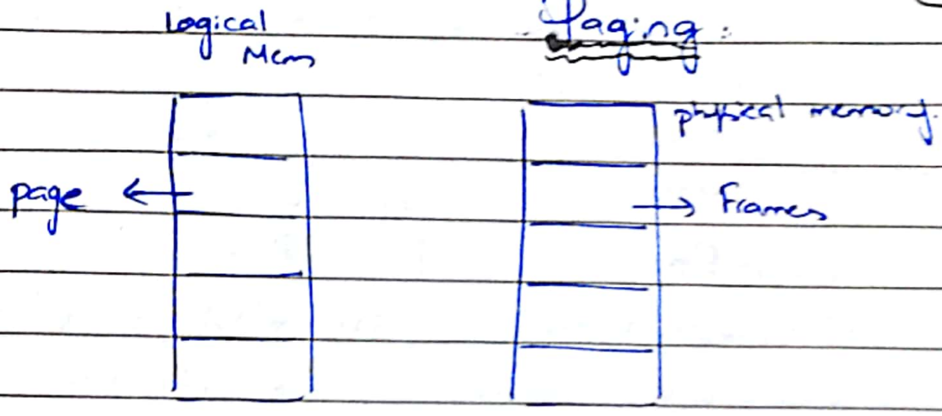
375 waiting

SOLO

Date

* $\underbrace{(\text{Base} + \text{logical}) > \text{Base} + \text{Limit}}_{\text{trap}}$

Paging:



$$\# \text{ of pages} = \frac{\text{Process size}}{\text{Page}}$$

example:

page size = 2,048 bytes
process size = 72,766 bytes.

$\# \text{ of pages} = \frac{72,766}{2048} \Rightarrow \underline{35 \text{ pages}} + 1086 \text{ bytes}.$ (can't be in decimal).

Internal fragmentation of $2048 - 1086 \Rightarrow \underline{962}$ Bytes. (wastage).
↓
internal fragmentation.

Date

(page size all numericals should be in 2^n (2 ki power))

Structure of Page table :

2^m 2^n

1) Heirarchical :

2^{32} $2^2 \cdot 2^{10} \Rightarrow 2^{12}$

logical Address = ~~2~~ 32 bit , page size : 4k . => 12

$1024 \times 4 \Rightarrow 4096$

p = ? , d = ?

(m-n) P : ~~2^3~~ $\frac{2^{32}}{2^{12}} \Rightarrow 2^{20}$ (2^{32} → logical add. ; 2^{12} → page size.)

$2^{20} \Rightarrow$ 20 bits.

p = 20 bits.

d = logical add − page ~~size~~ table

d : 32 − 20 => 12 . bits.

PN # 02.

(if given in decimal then
for p = given/page size
d = given mod 1024.)

2) Hash page table :

pg table → hash value
Cluster of pages.

3) Inverted page table

page → pid

PN # 03.

Q_2 Consider a ~~logging~~ ~~logg~~ logical/ virtual address of 64 pages of 1024 words each mapped onto physical memory of 32 frames.

($64 = 2^6$, $1024 = 2^{10}$, $32 = 2^5$)

c) Bits in logical address = ?

$=(6+10) \Rightarrow$ ~~2~~ $16 \Rightarrow 2^{16}$

page table entries = $\frac{2^{16}}{2^{10}} \Rightarrow 2^6 \Rightarrow$ 6 bits.

SOLO

Date

b) Bits in physical address = ?

$\Rightarrow (5 + 10) \Rightarrow 15 \Rightarrow 2^{15}$

Page table entries $= \frac{2^{15}}{2^{10}} \Rightarrow 2^5$

logical Add. = 16 bits. $(2^{16}) \Rightarrow 2^m$

page size = 5 bits. $(2^5) \Rightarrow 2^n$

p = ? , d = ?

p = m - n , d = logical Address - P =

p = 11 , d = 16 - 11 => ~~d~~ 5.

Page entries $= \frac{LA \Rightarrow}{PS \Rightarrow}$

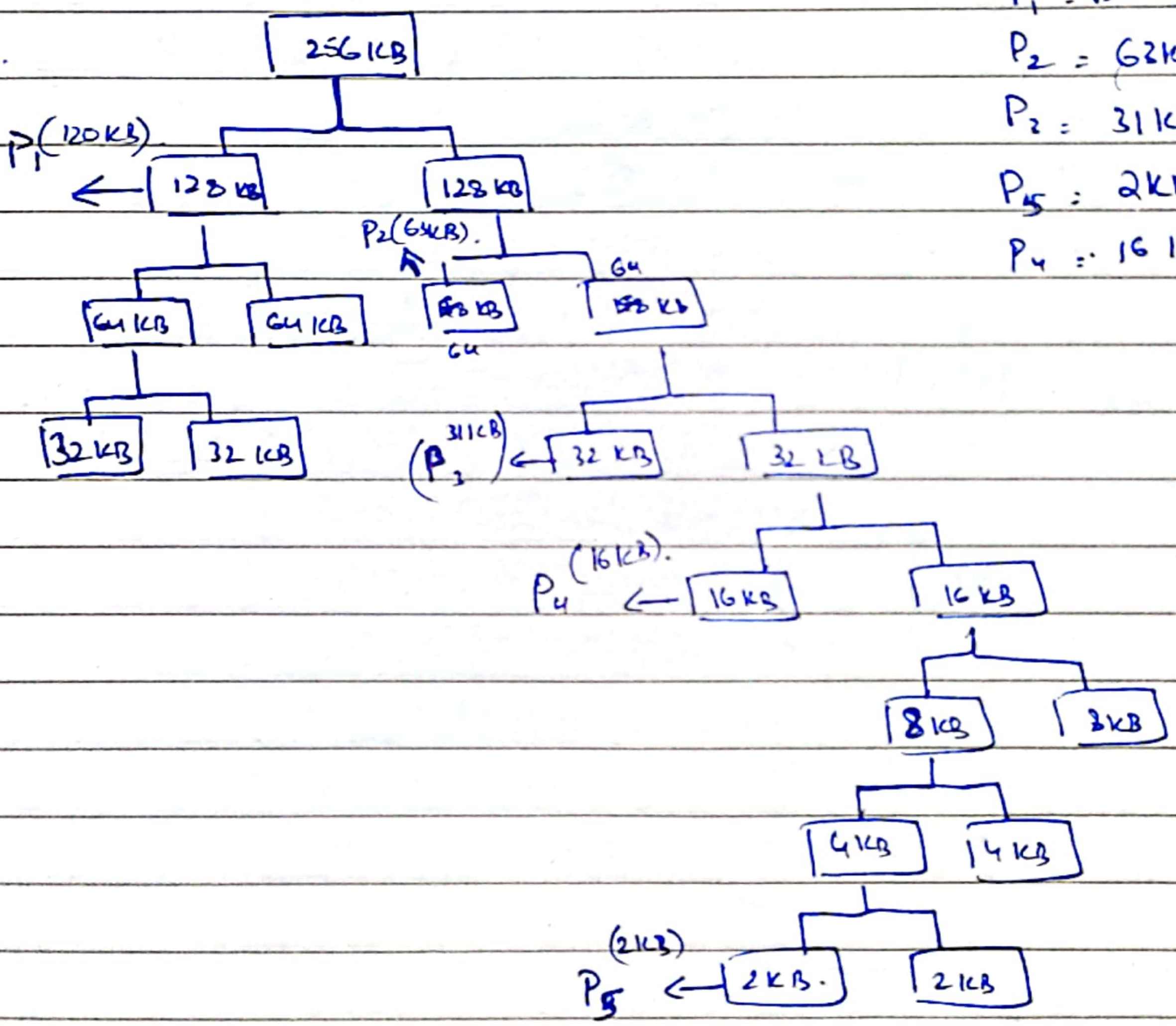
$= \frac{PA}{\cancel{LA} \Rightarrow \text{Frames}}$

PS

heavy

Date ________

Buddy System Allocator :



P_1 = 120 KB

P_2 = 63 KB

P_3 = 31 KB

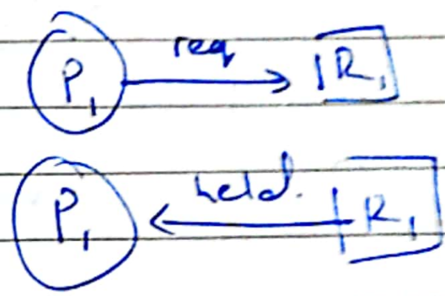
P_5 : 2 KB.

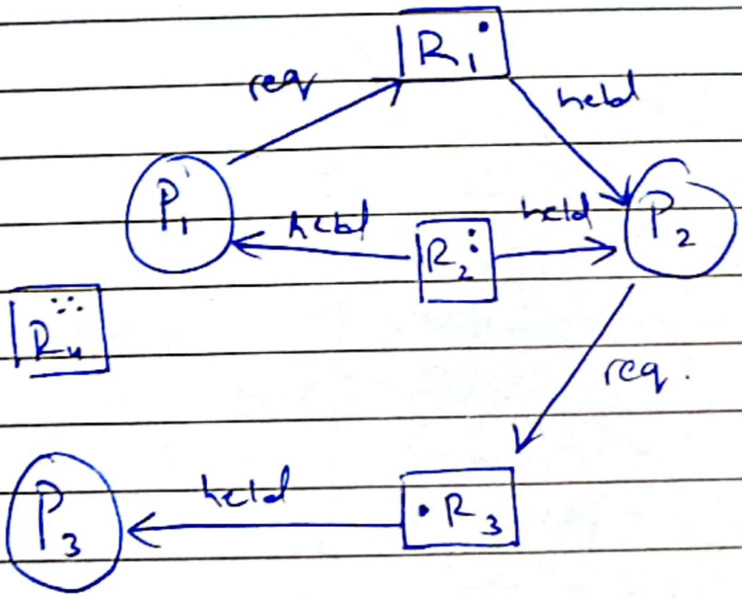
P_4 : 16 KB

Date

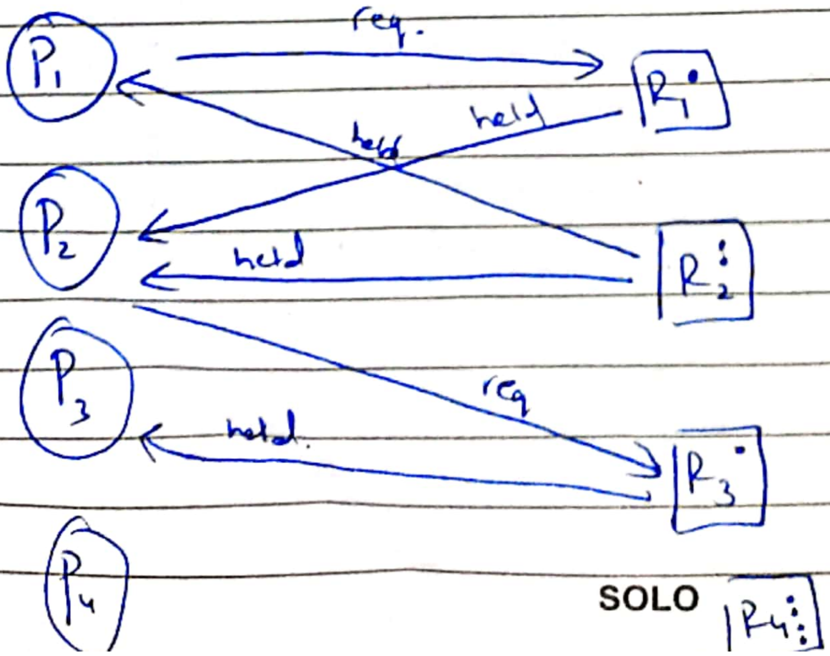
Resource Allocation Graph.

One instance of R_1 — P_1 holding R_2 & waiting for R_1
2 " " R_2 — P_2 R_1 & R_2 " " " R_3
1 " " R_3 — P_3 " R_3
4 " " R_4



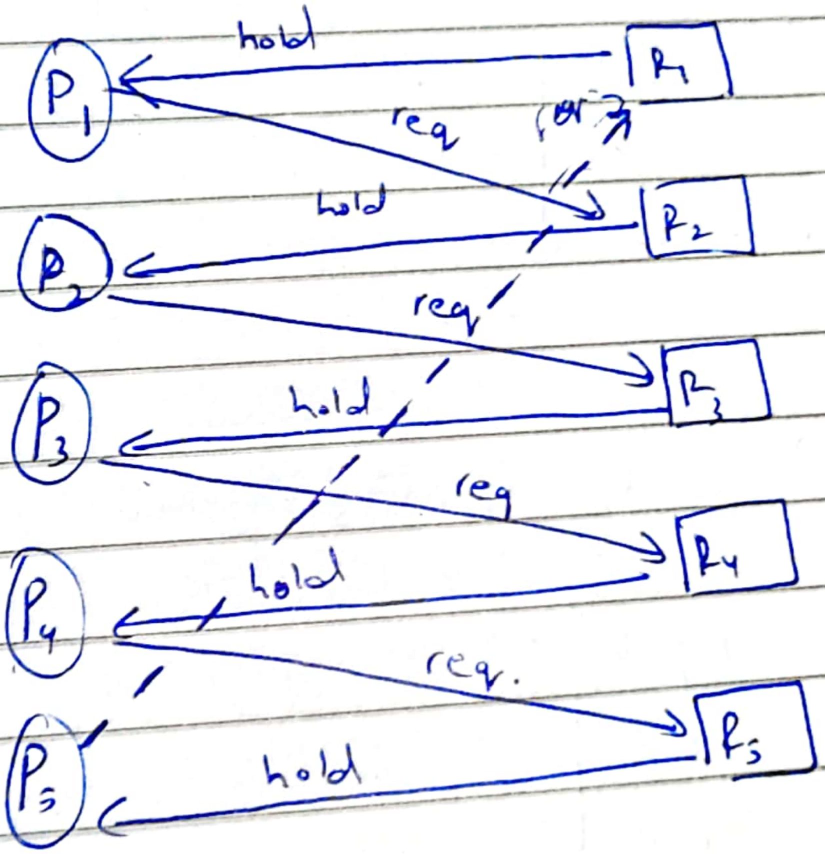


OR.



Date

Dining Philosopher's Problem.
(RAG).
(5 philosopher, 5 Chopsticks(res.)).



Date ________

FIFO, LRU, OPTIMAL.

FIFO : ↓ ↓ ↓ H ↓ ↓ ↓
1, 3, 0, 3, 5, 6, 3. => 6 page fault.

2	0		2	0		2	~~0~~ 3
1	3		1	3		1	6
0	1		0	5		0	5

LRU : ↓ ↓ ↓ H ↓ ↓ H
1, 3, 0, 3, 5, 6, 3 => 5 page fault

2	0		2	0		2	6
1	3		1	3		1	3
0	1		0	5		0	5

Optimal : ~~1,3,0,3,5,6~~, 3. ↓ ↓ ↓ ↓ H ↓ H ↓ H H H H H H
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 3.

3	2.		3	2		3	2
2	1		2	1		2	4
1	0		1	0		1	0
0	7		0	3		0	3

6 page fault.