OS - May 2024

Q.2] Given: String → 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1

→ b

→ i. LRU (Least Recently Used)

Note: ~~Replacety~~ Replacing the least recently used page in the past.

frames

f_4				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
f_3			1	1	1	1	1	4	4	4	4	4	4	1	1	1	1	1	1	1
f_2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
f_1	7	7	7	7	7	3	3	3	3	3	3	3	3	3	3	3	3	7	7	7
Strings →	7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
	x	x	x	x	Hit	x	Hit	x	Hit	Hit	Hit	Hit	Hit	x	Hit	Hit	Hit	x	Hit	

Page faults = 8

Page Hits = 12

→ ii. FIFO (First In First Out)

f_4				2		2		2		2			1	1		1				
f_3			1	1		1		1		0			0	0		0				
f_2		0	0	0		0		4		4			4	4		7				
f_1	7	7	7	7		3		3		3			3	2		2				
Strings →	7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
	x	x	x	x	✓	x	✓	x	✓	✓	x	✓	✓	x	x	✓	✓	x	✓	✓

Page faults = 10

Page Hits = 10

→iii. Optimal page replacement algorithm

Note: Replace the page which is not used in longest IN THE FUTURE.

f_4				2		2		2					2				2			
f_3			1	1		1		4					4				7			
f_2		0	0	0		0		0					0				0			
f_1	7	7	7	7		3		3					1				01			
Stages→	7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
	×	×	×	×	✓	×	✓	×	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓

Ans Page faults = 8

Page Hits = 12

Q.3] Given :

→b Partition sizes = 400, 180, 100, 300, 45

Process es : =

95, 180, 285, 380, 30
P1 P2 P3 P4 P5

→i. First Fit Method

400 kb	P1 (95)	Remaining – 305 kb
180	P2 (180)	Perfect Fit
100	P3 –	Cannot accomodate
300	–	
45	P5 (30)	Remaining. – 15 kb

→ iii. Best fit Method

400 kb	P4 (380 kb)
180 kb	P2 (180 kb)
100 kb	P1 (95 kb)
300 kb	P3 (288 kb)
45 kb	P5 (30 kb)

Remain → 20 kb
Q. Perfect fit
Remain - 5 kb
Remain - 13 kb
Remain. - 15 kb

[Q.6]

→ A (i: Literal & Arrival time | (Non-Preemptive)

→ i. FCFS (first come first serve)

Process Name	Burst time (ms)	Arrival time (ms)	Completion time	Turn Around time	Waiting time
P1	24	0	24	24	0
P2	7	3	31	28	21
P3	6	5	37	32	26
P4	10	10	47	37	27

Gantt Chart

P1	P2	P3	P4
0	24	31	37	47

Note: * Turn-Around Time = Completion time - Arrival time

* Waiting time = Turn Around time - Burst time

Avg. waiting time (FCFS) = $\frac{0 + 21 + 26 + 27}{4}$

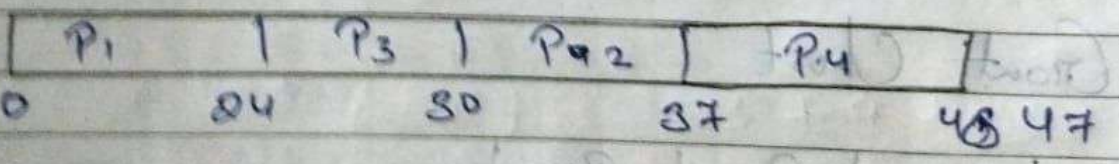
Ans = 18.5

Q99. SJF (Shortest Job First)

Note: Criteria : "Burst time"
Mode : "Non-Preemptive"

Process Name	B.T	A.T	C.T	TAT	W.T
P_1	24	0	24	24	0
P_2	7	3	37	34	27
P_3	6	5	30	25	19
P_4	10	10	47	37	27

Gantt Chart



Avg. W.T (SJF) = $\frac{0 + 27 + 19 + 27}{4}$

Ans = 18.25

→ iii. Priority (Preemptive).

Note: Criteria: Priority

	Process Name	B.T	A.T	Priority	C.T	TAT	W.T
low priority →	P_1	~~24~~ 21	0	5	47	47	23
	P_2	~~7~~ 5	3	3	26	23	16
	P_3	~~6~~ 1	5	2	21	16	10
High priority →	P_4	10	10	1	20	10	0

Note: Given: Smaller number = Higher priority

Gantt Chart:

→ Running Queue

P_1	P_2	P_3	P_4	P_3	P_2	P_1
0	3	5	10	20	21	26	47

~~P_1 P_2 P_3~~

Ready Queue

Avg. WT (Priority) = $\frac{23 + 16 + 10 + 0}{4}$

→ Avg - iii = **12.25**

→ Round Robin Scheduling. (Preemptive)

Process Name	B.T	A.T	C.T	TAT	W.T
P_1	24	0	47	47	23
P_2	7	3	19	16	9
P_3	6	5	29	24	18
P_4	10	10	39	29	19

Given : Time Quantum = 4

Ready queue → P_1 | P_2 | P_3 | P_3 | P_2 | P_4 | P_1 | P_3 | P_4 | P_1 | P_4

P_1	P_2	P_3	P_3	P_2	P_4	P_1	P_3	P_4	P_1
0	4	8	12	16	19	23	27	29	33

Ready queue

Running

P_4	P_1	P_1
37	39	43	47

→ Avg. WT (RR) = $\frac{23 + 9 + 18 + 19}{4}$

Ans → RV = **17.25**

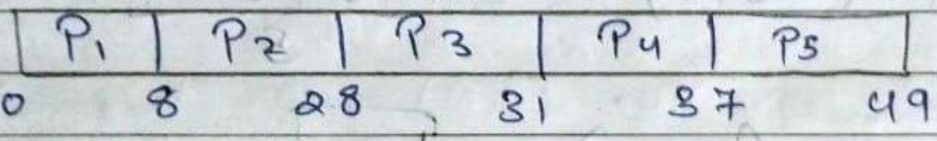
OS - May 2023

Q.2] FCFS

→ a.

Process	B.T	A.T	C.T	TAT	W.T
P_1	8	0	8	8	0
P_2	20	1	28	27	7
P_3	3	2	31	29	26
P_4	6	3	37	34	28
P_5	12	4	49	45	33

Gantt Chart



Avg. (W.T) FCFS = $\frac{0+7+26+28+33}{5}$

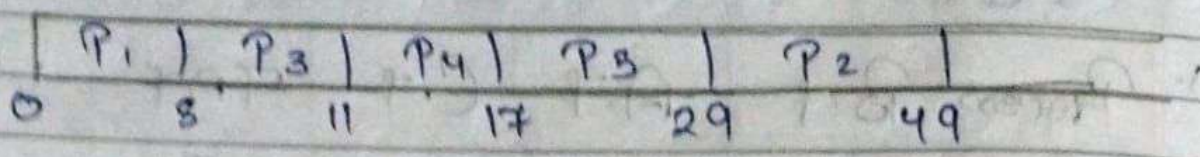
∴ Avg. WT (FCFS) = 18.8

Avg TAT (FCFS) = 28.6

→ 2] SJF

Process	B.T	A.T	C.T	TAT	W.T
P_1	8	0	8	8	0
P_2	20	1	49	48	28
P_3	3	2	11	9	6
P_4	6	3	17	14	8
P_5	12	4	29	25	13

Gantt Chart



Avg TAT (SJF) = $\frac{8+48+9+14+25}{5}$

∴ Avg TAT (SJF) = **20.8**

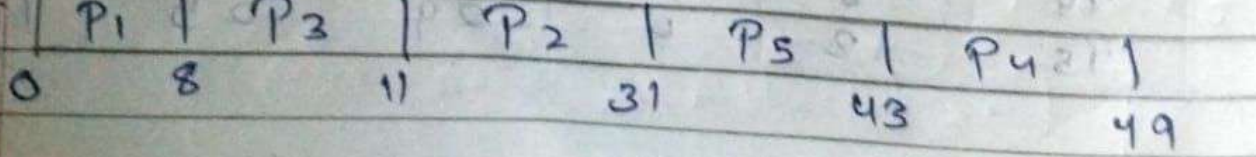
Avg WT (SJF) = $\frac{0+28+6+8+13}{5}$

∴ Avg. WT (SJF) = **11**

→3] Priority Scheduling

Process	B.T.	A.T	Priority	C.T	TAT	W.T
P_1	8	0	1	8	8	0
P_2	20	1	3	81	30	10
P_3	3	2	2	11	9	6
P_4	6	3	5	49	46	40
P_5	12	4	4	43	39	27

Gantt Chart:



Avg TAT (Priority) = $\frac{8+30+9+46+39}{5}$

∴ Avg TAT (Priority) = 26.4

Avg WT (Priority) = $\frac{0+10+6+40+27}{5}$

∴ Avg WT (Priority) = 16.6

⇒ 4) Round Robin (Time Quantum = 5)

Process	B.T	A.T	C.T	TAT	W.T
P_1	~~8~~ 3	0	26	26	18
P_2	20, ~~15~~ 10	1	49	48	28
P_3	~~3~~	2	13	11	8
P_4	~~6~~ 1	3	32	29	23
P_5	~~12~~ ~~7~~ 2	4	44	40	28

Ready Queue → ~~P_1~~ | ~~P_2~~ | ~~P_3~~ | ~~P_4~~ | ~~P_5~~ | ~~P_1~~ | ~~P_2~~ | ~~P_4~~ | ~~P_5~~ | ~~P_2~~ | ~~P_5~~ | P_2

Gantt Chart

P_1	P_2	P_3	P_4	P_5	P_1	P_2	P_4	P_5

0 5 10 13 18 23 26 31 32 37

Running Queue

P_2	P_5	P_2

37 42 44 49

Avg. TAT (RR) = $\frac{26+48+11+29+40}{5}$

∴ Avg. TAT (RR) = 30.8

Avg. WT (RR) = $\frac{18+28+8+23+28}{5}$

∴ Avg WT (RR) = 21

Q.3] Given: (The Question is Wrong)

4 Process = P_1, P_2, P_3, P_4
5 Resources = R_1, R_2, R_3, R_4, R_5

Matrices provided:

C (Current Allocation)
R (Request Matrix) ⇌ (Max need)

E (Existing Resources) = (2 4 1 4 4)
A (Available Resources) = (0 1 0 2 1)

Note: Available resources & Work are same.

Note: To calculate need "Remaining Need":

(Max need - Allocation)

Given:

Q.4] String: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

→a. Frame size = 4

→i. FIFO

f_4				4			4	4	4	1		1	1	1		2	2			2
f_3			3	3			3	3	2	2		2	2	6		6	6			6
f_2		2	2	2			2	6	6	6		6	7	7		7	7			3
f_1	1	1	1	1			5	5	5	5		3	3	3		3	1			1
String→	1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
	×	×	×	×	✓	✓	×	×	×	×	✓	×	×	×	✓	×	×	✓	×	✓

Page faults = 14

Page Hit = 6

→ii. Optimal Page Replacement

f_4				4			5	6					6			6				
f_3			3	3			3	3					3			3				
f_2		2	2	2			2	2					2			2				
f_1	1	1	1	1			1	1					7			1				
String→	1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6
	×	×	×	×	✓	✓	×	×	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	✓

Page faults = 8

Page Hit = 12

→ iii. LRU

f_4				4			4	6				6	7	7			1					
f_3			3	3			5	5				3	3	3			3					
f_2		2	2	2			2	2				2	2	2			2					
f_1	1	1	1	1			1	1				1	1	6			6					
String →	1	2	3	4	2	1	5	6	2	1	2	3	7	6	3	2	1	2	3	6		
	×	×	×	×	✓	✓	×	×	✓	✓	✓	×	×	×	✓	✓	×	✓	✓	✓		

Page faults = 10 Page Hits = 10