1.) here, given:

Process name:	Arrival time	Service Time
A	0	5
B	1	3
C	2	2
D	3	6
E	4	4

(1.) FCFS.

Gantt chart:

P1	P2	P3	P4	P5

0 5 8 10 16 20

	AT	ST	~~ST~~	CT	TAT	WAT
A	0	5		5	5	0
B	1	3		8	7	4
C	2	2		10	8	6
D	3	6		16	13	7
E	4	4		20	16	12

Avg TAT = 9.8 sec

Avg WT = 5.8 sec

(2.) Round Robin

Gantt chart:

P1	P2	P3	P4	P5	P1	P2	P4	P5	P1	P4

0 2 4 6 8 10 12 13 15 17 18 20

CT	TAT	WAT
14	14	9
13	12	9
6	4	2
20	17	11
18	14	10

$$\text{Avg TAT} = \frac{14+12+4+17+14}{5} = 12.2$$

$$\text{Avg WAT} = \frac{9+9+2+11+10}{5} = 8.2$$

(3.) SRTN

P1	P2	P3	P1	P5	P4

0 1 4 6 10 14 20

CT	TAT	WAT.
10	10	5
4	3	0
6	4	2
20	17	11
14	10	6

Avg TAT = 8.8

Avg WT = 4.8

(4.) SJF.

P1	P3	P2	P5	P4

1 5 7 10 14 20.

CT	TAT	WAT
5	5	0
10	9	6
7	5	3
20	17	11
14	10	6

$$\text{Avg TAT} = \frac{5+9+5+17+10}{5} = 9.2$$

$$\text{Avg WAT} = \frac{0+6+3+11+6}{5} = 5.2$$

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2) here, since NEED matrix = MAX − ALLOCATION;
The content of need matrix is as follows,

	MAX	−	ALLOCATION	NEED (A B C D)
P_0	0 0 1 2		0 0 1 2	0 0 0 0
P_1	1 7 5 0		1 0 0 0	0 7 5 0
P_2	2 3 5 6		1 3 5 4	1 0 0 2
P_3	0 6 5 2		0 6 3 2	0 0 2 0
P_4	0 6 5 6		0 0 1 4	0 6 4 2

(1.) Need matrix obtained:

A	B	C	D
0	0	0	0
0	7	5	0
1	0	0	2
0	0	2	0
0	6	4	2

ii.) The system is in safe state.
→ process served in order : P_0 P_2 P_1 P_3 P_4

	A B C D
↳ before seving P_0, availbable resoruses	1 5 2 0
↳ after serving P_0,	1 5 3 2
↳ after serving P_2,	2 8 8 6
↳ after seriving P_1,	3 8 8 6
↳ after serving P_3,	3 14 11 8
↳ after serving P_4,	3 14 12 12

So the availbolable resorses are suffiçeint for the processes to terminate.
So the system is in safe state

iii.) Yes that request can be grated immediately and still the system will be in safe state.

→ because after serving that request, this results in the value of Available being (1,1,0,0)

	Allocation	Max	Need	Available
P0	0012	0012	0000	1100
P1	1420	1750	0330	
P2	1354	2356	1002	
P3	0632	0652	0020	
P4	0014	0656	0642	

work = available = 1100

→ work = work + allocation

work: P0 = 1100 + 0012 = 1112

P2 = 1112 + 1354 = 2466

P3 = 2466 + 0632 = 2 10 9 8

P4 = 2 10 9 8 + 0 0 1 4 = 2 10 10 12

P1 = 2 10 10 12 + 1 4 2 0 = 3 14 12 12

∴ Safe sequence = P0 P2 P3 P4 P1

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3) here given page trace= 4, 3, 2, 1, 4, 3, 5, 4, 3, 2, 1, 5

→ FIFO:

	4	3	2	1	4	3	5	4	3	2	1	5
F_1	4	4	4	4	4	4	5	5	5	5	1	1
F_2		3	3	3	3	3	3	4	4	4	4	5
F_3			2	2	2	2	2	2	3	3	3	3
F_4				1	1	1	1	1	1	2	2	2
faults	F	F	F	F			F	F	F	F	F	F

total page faults = 10

→ OPTIMAL.

	4	3	2	1	4	3	5	4	3	2	1	5
F_1	4	4	4	4	4	4	4	4	4	4	1	1
F_2		3	3	3	3	3	3	3	3	3	3	3
F_3			2	2	2	2	2	2	2	2	2	2
F_4				1	1	1	5	5	5	5	5	5
	F	F	F	F			F				F	

total page faults = 6.

→ LRU

	4	3	2	1	4	3	5	4	3	2	1	5
F_1	4	4	4	4	4	4	4	4	4	4	4	5
F_2		3	3	3	3	3	3	3	3	3	3	3
F_3			2	2	2	2	5	5	5	5	1	1
F_4				1	1	1	1	1	1	2	2	2
faults	F	F	F	F			F			F	F	F

total page faults = 8

4) here,
Given memory portions of size : (in order)
100 KB , 500 KB , 200 KB, 300 KB, 600 KB

processes: (in order
212 KB 417 KB 112 KB 426 KB

→ First fit:
212 K is put in 500 K partition
417 K is put in 600 K partition
112 K is put in 288 K partition
(∵ as new partition 288 K = 500 K - 212 K)
426 K must wait.

→ Best-fit
212 K is put in 600 K partition
417 K is put in 500 K partition
112 K is put in 200 K partition
426 K is put in 600 K partition

→ Worst fit
212 K is put in 600 K partition
417 K is put in 500 K partition
112 K is put in 388 K partition
426 K must wait.

∴ In this problem, best-fit turns out to be the best.

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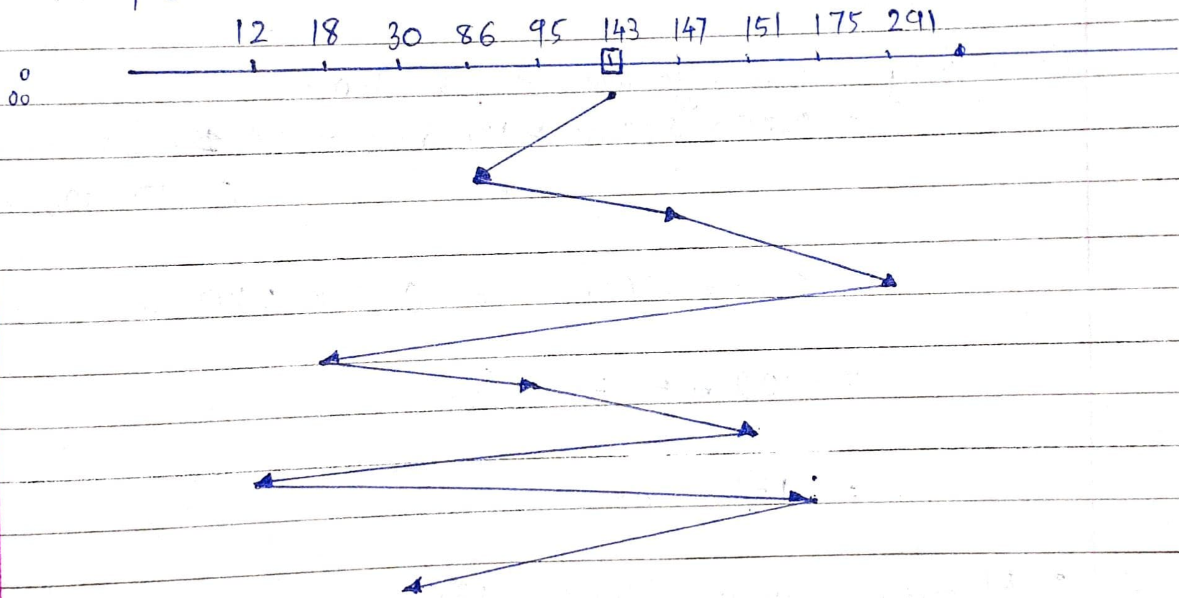
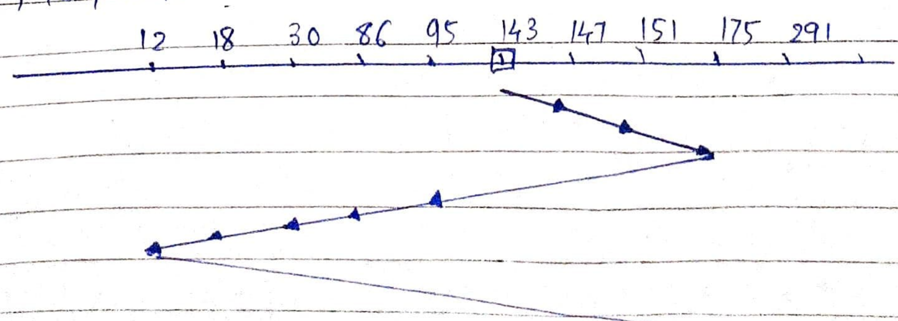
5.) here,
Given : total number of cylinders : 300 [0 - 299]
drive currently serving at : 143.
previous request served was at : 15
queue of pending request : 86, 147, 291, 18, 95,
151, 12, 175 and 30

(1.) FCFS algorithm
request served queue : 143, 86, 147, 291, 18, 95, 151, 12,
175, 30



∴ Total distance : 57 + 61 + 144 + 273 + 77 + 56 + 139 + 163 + 145
= 1115

(2.) SSF algorithm
request served queue : 143, 147, 151, 175, 95, 86,
30, 18, 12, 291



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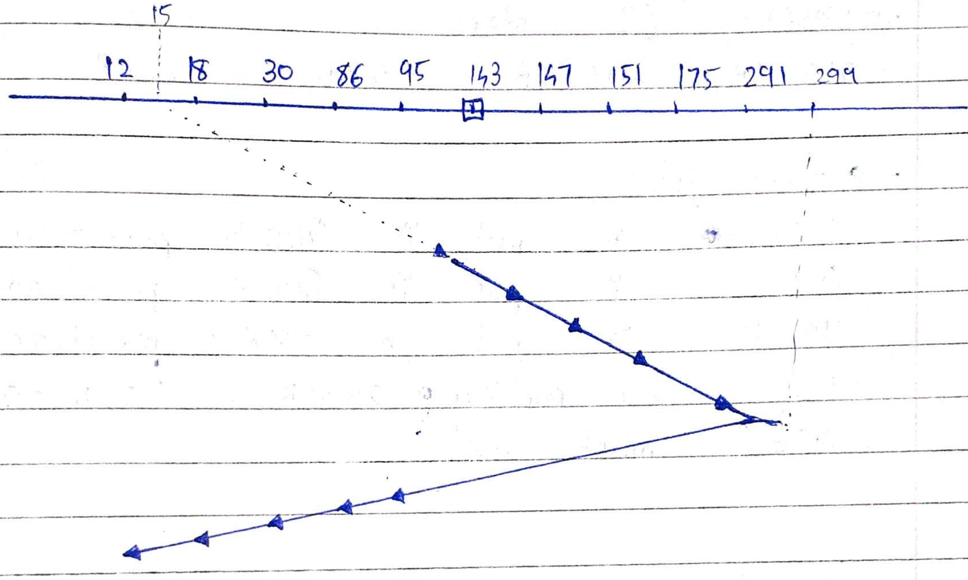
Total distance: $4+4+24+80+9+56+12+6+279 = 474$

(3) SCAN algorithm

request served queue: 143, 147, 151, 175, 291, 95, 86, 30, 18, 12

~~Total~~



Total distance:

$(299 - 143) + (299 - 12)$

$= 443.$

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6:) here,

Given : Number of level of page table = 1

TLB access time = 20 ns

Main memory access time = 100 ns

TLB hit ratio = 85 % = 0.85

Calculating TLB miss ratio:

= 1 - TLB miss ratio

= 1 - 0.85

= 0.15

Calculating ~~TLB~~ effective access time:

$= 0.85 \times \{20\text{ ns} + 100\text{ ns}\} + 0.15 \times \{20\text{ ns} + (1+1) \times 100\text{ ns}\}$

$= 0.85 \times 120\text{ ns} + 0.15 \times 220\text{ ns}$

$= 102\text{ ns} + 33\text{ ns}$

$= 135\text{ ns}$

∴ Effective access time: 135 ns.