COMPUTER SCIENCE & I.T

OPERATING SYSTEMS

CPU Scheduling

LECTURE - 01

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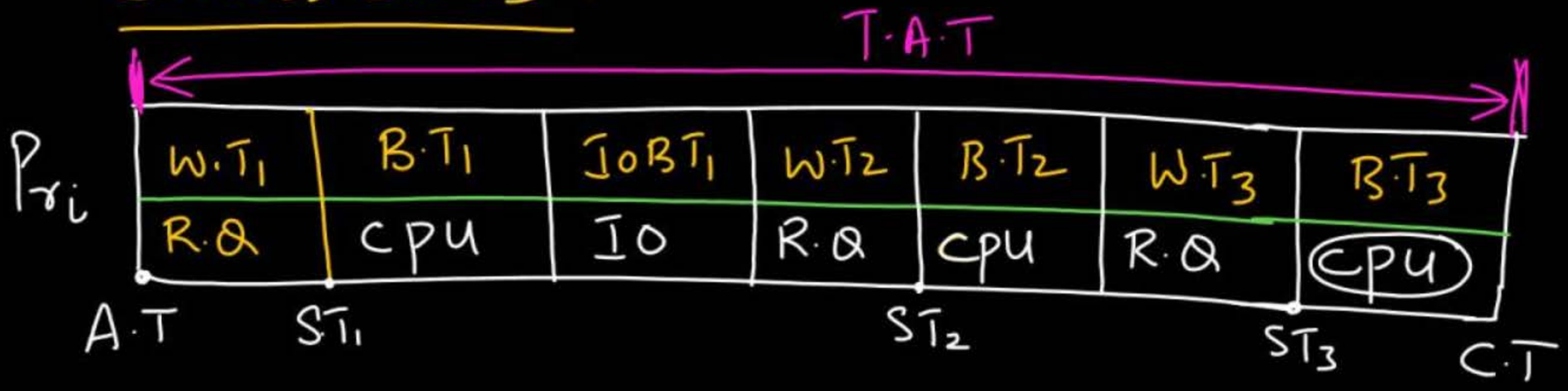
1- FCFS

SJF

Process Times :



1) Arrival time (A·T)
2) Waiting time (W·T)
3) Scheduling time (S·T)
4) Burst time (B·T)
5) Completion time (CT)
6) Turn Around Time (TAT) = CT − AT

Waiting Time (WT) = TAT − (BT + IoBT)

→ Total time spent by Process in R·Q

Scheduling framework

→ 'n' : no. of Processes
→ a_i : A.T of Process P_i
→ c_i : C.T of Process P_i
→ x_i : B.T of P cess P_i
→ y_i : IO/BT of Process P_i

1) $TAT(P_i) = c_i - a_i$

2) $Avg.\ TAT = \dfrac{\sum_{i=1}^{n}(c_i - a_i)}{n}$

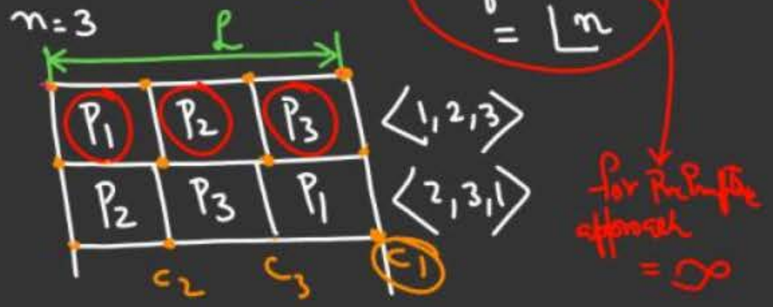
3) $w.T(P_i) = (c_i - a_i) - (x_i + y_i)$

4) $Avg.\ w.T = \dfrac{\sum_{i=1}^{n}(c_i - a_i) - (x_i + y_i)}{n}$

$TAT = CT - AT$

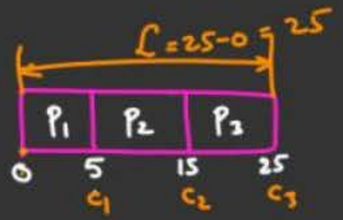
Schedule length (L):

No. of Schedules = $\lfloor n$ (Non-Pr)



L = Total time taken to complete all 'n' processes as per the Schedule; = (Completion time of last Process) − (Arrival time of First Process)

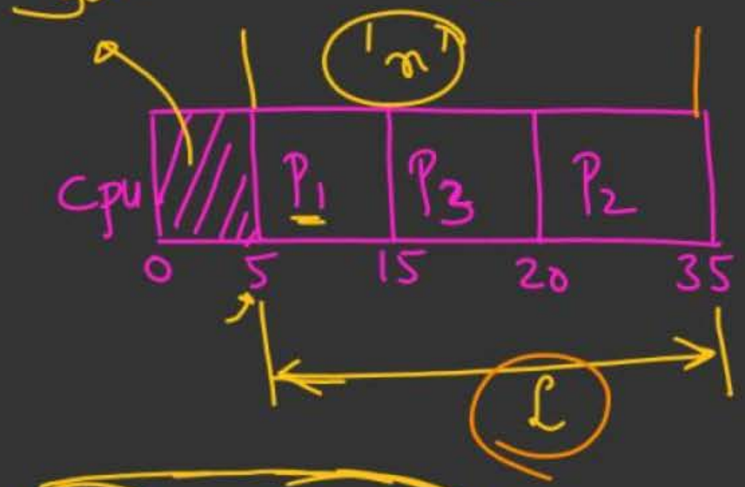
$$L = Max(c_i) - Min(A_i)$$



Max(C1,C2,C3) = 25
Min(a1 a2 a3) = 0

Idleness

L = 35 - 5 = 30



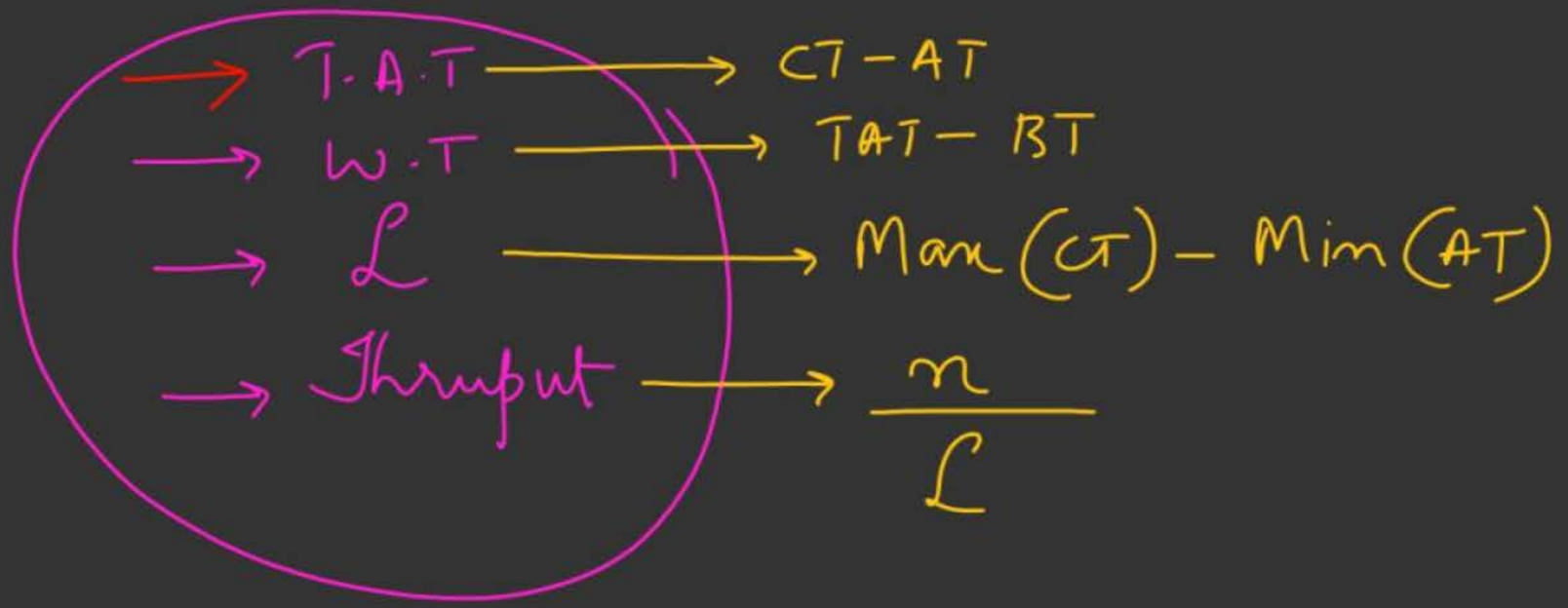
n
a_i
c_i
W.T
TAT
L

Throughput (η):

(No. of Processes Completed Per Unit_Time;)

n — L units
? — 1 unit

$$\eta = \frac{n}{L}$$


T.A.T
W.T
L
Throughput
CT - AT
TAT - BT
Max(CT) - Min(AT)
n / L

CPU Scheduling Techniques/Algorithms

N.Pr | Pr

<Design of S.T.S>

(i) First Come First Served (FCFS)

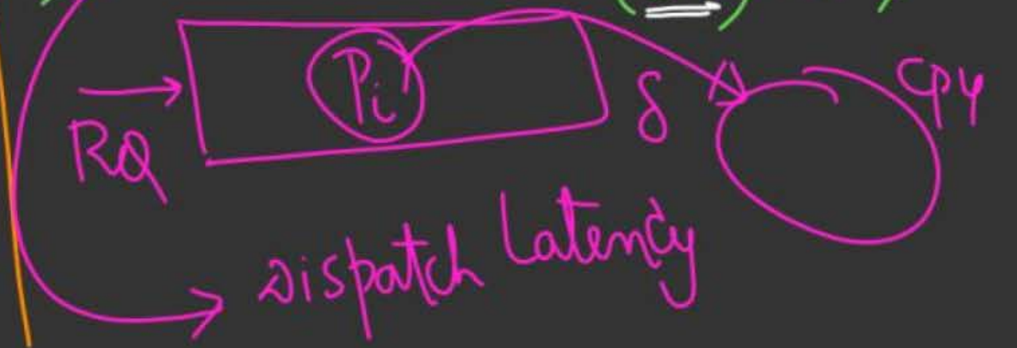
→ Selection criteria: A.T

→ Mode of operation: N.Pr

→ Conflict Resolution: Lower Pid
Tie breaking rule

Assumptions:

1) Time is in clock ticks
2) No IOBT
3) Scheduling ovhd (δ) (δ=0) = Negligible



1. FCFS

TAT = CT − AT | WT = TAT − BT

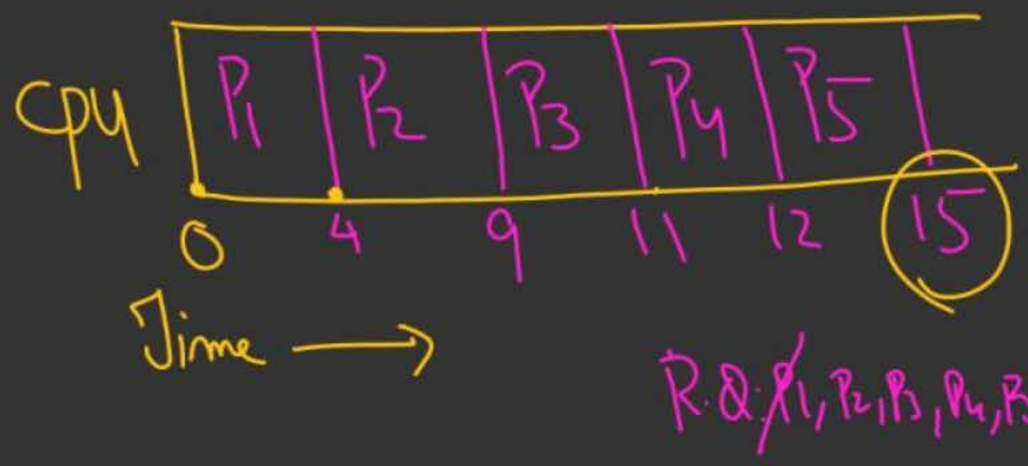
P.No	A.T	B.T	S.T	CT	TAT	W.T
1	0	4	0	4	4	0
2	0	5	4	9	9	4
3	0	2	9	11	11	9
4	0	1	11	12	12	11
5	0	3	12	15	15	12

$L = 15 - 0 = 15$

Avg. TAT $= \frac{51}{5} = 10.2$

Av. WT $= \frac{36}{5} = 7.2$

Gantt chart



R.Q: ~~P1~~, P2, P3, P4, P5

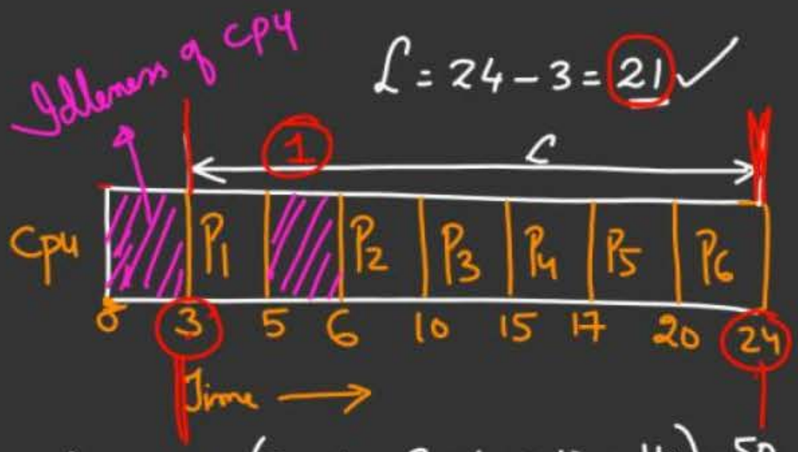
FCFS

P.No	A.T	B.T
×1	3	2
2	6	4
3	7	5
4	7	2
5	8	3
6	10	4

$L =$

Av.TAT =

Av.W.T =



$L = 24 - 3 = 21$ ✓

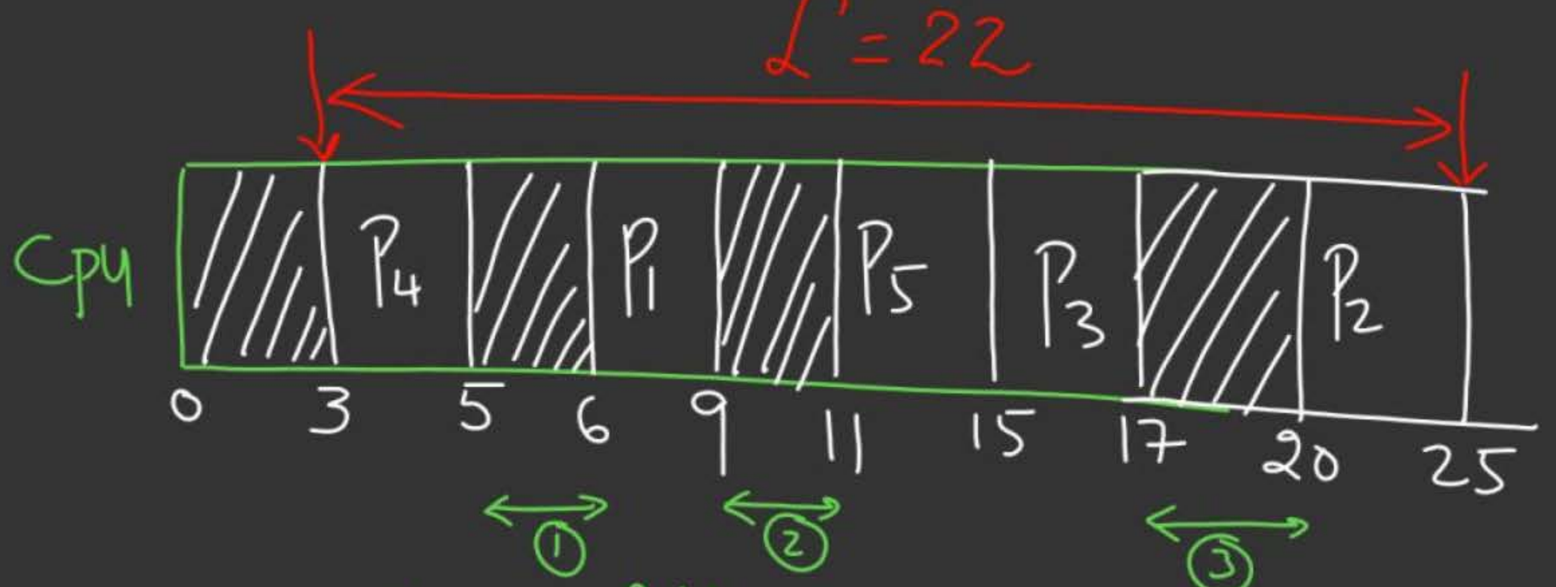
$$\text{Av.TAT} = \frac{(2+4+8+10+12+14)}{6} = \frac{50}{6} = 8.33$$ ✓

$$\text{Av. W.T} = \frac{0+0+3+8+9+10}{6} = \frac{30}{6} = 5$$ ✓

$$\frac{\%\ \text{CPU-Idleness}}{L} = \frac{1}{21}$$

$$= \left(\frac{1}{21}\right) \times 100 = 4.7\%$$

P.No	A.T	B.T
1	6	3
2	20	5
3	14	2
→ 4	3	2
5	11	4



$$\% \text{ CPU-Idleness} = \frac{6}{22} = \left(\frac{3}{11}\right) \times 100$$

$$L$$

FCFS with non-negligible Scheduling ovhd

δ = 1 unit

$W.T = TAT - (BT + \delta)$

7 - (3+1)

P.No	A.T	B.T
1	0	2
2	0	3
3	0	5

13-(5+1)

13-6

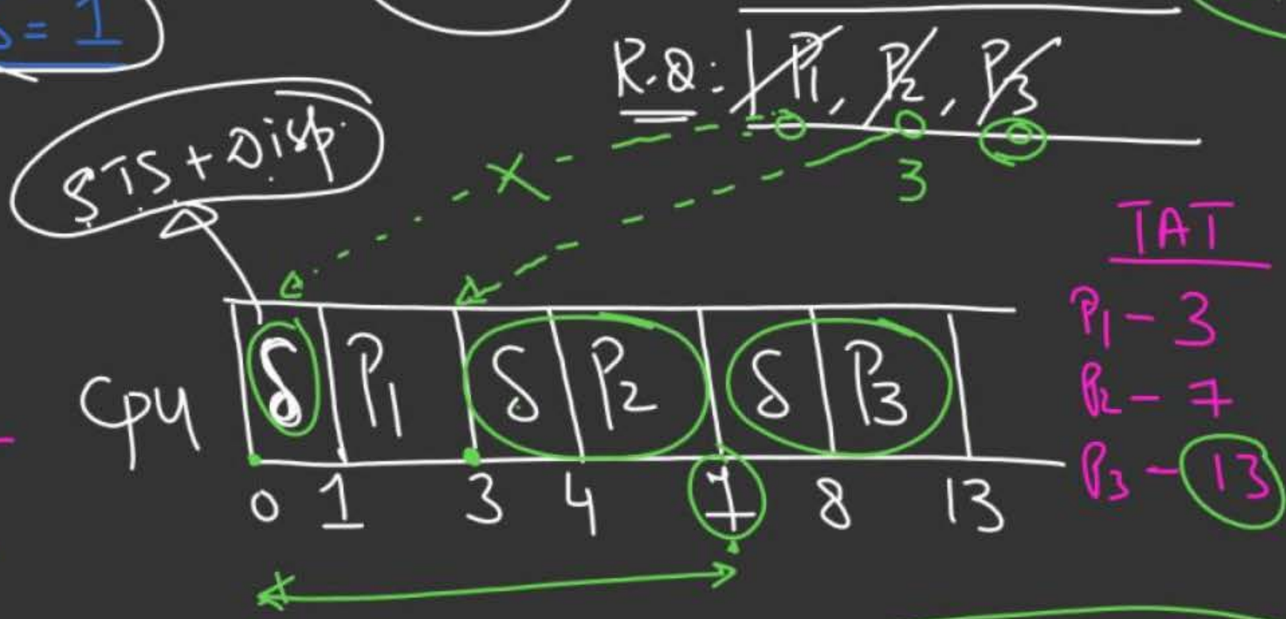
= 7

δ = 1 = Scheduling ovhd

TAT = CT - AT

WT = TAT - BT

3-2=1



TAT
P_1 - 3
P_2 - 7
P_3 - 13

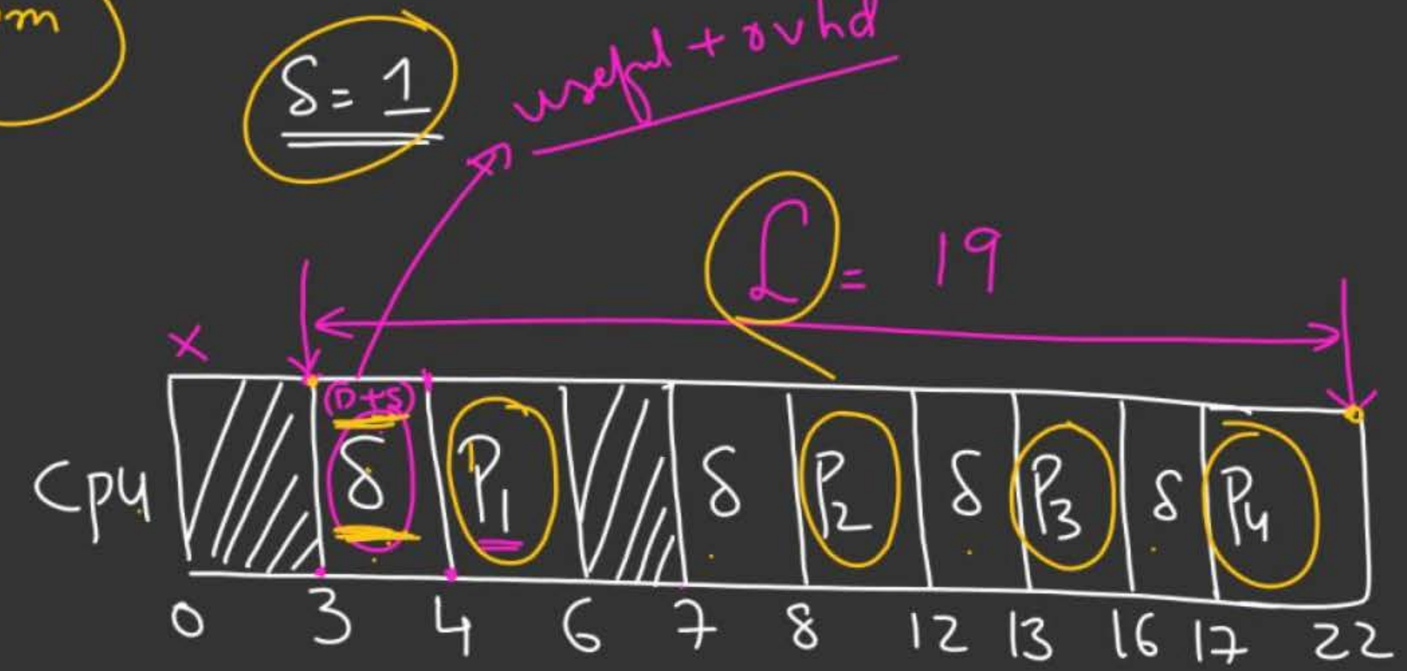
W.T
P_1 - 0
P_2 - 3
P_3 - 7

W.T = Time Spent by the Process in R.Q

7:50 pm

$S = 1$;

P.No	A.T	B.T	W.T	TAT
1	3	2	0	3
2	7	4	0	5
3	8	3	4	8
4	10	5	6	12



① $\%\ \text{cpu-Idleness} = \frac{1}{L} = \frac{1}{19} = 5.2\%$

② $\%\ \text{cpu-ovhd} = \frac{4}{L} = \frac{4}{19} = 21\%$

③ $\%\ \text{cpu-Efficiency} = 100 - (21 + 5.2\%) = x\%$


THANK
YOU!